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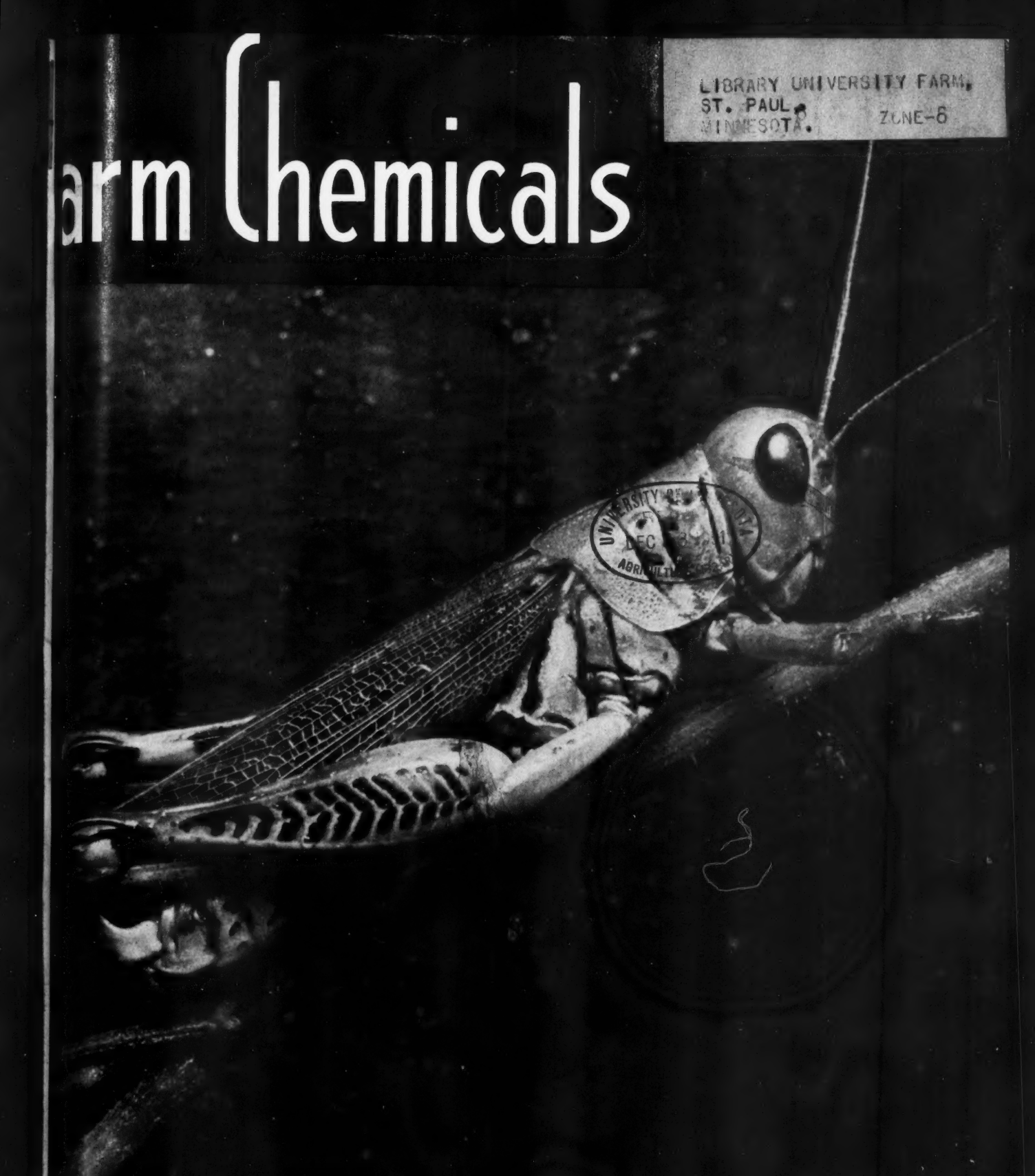
arm Chemicals



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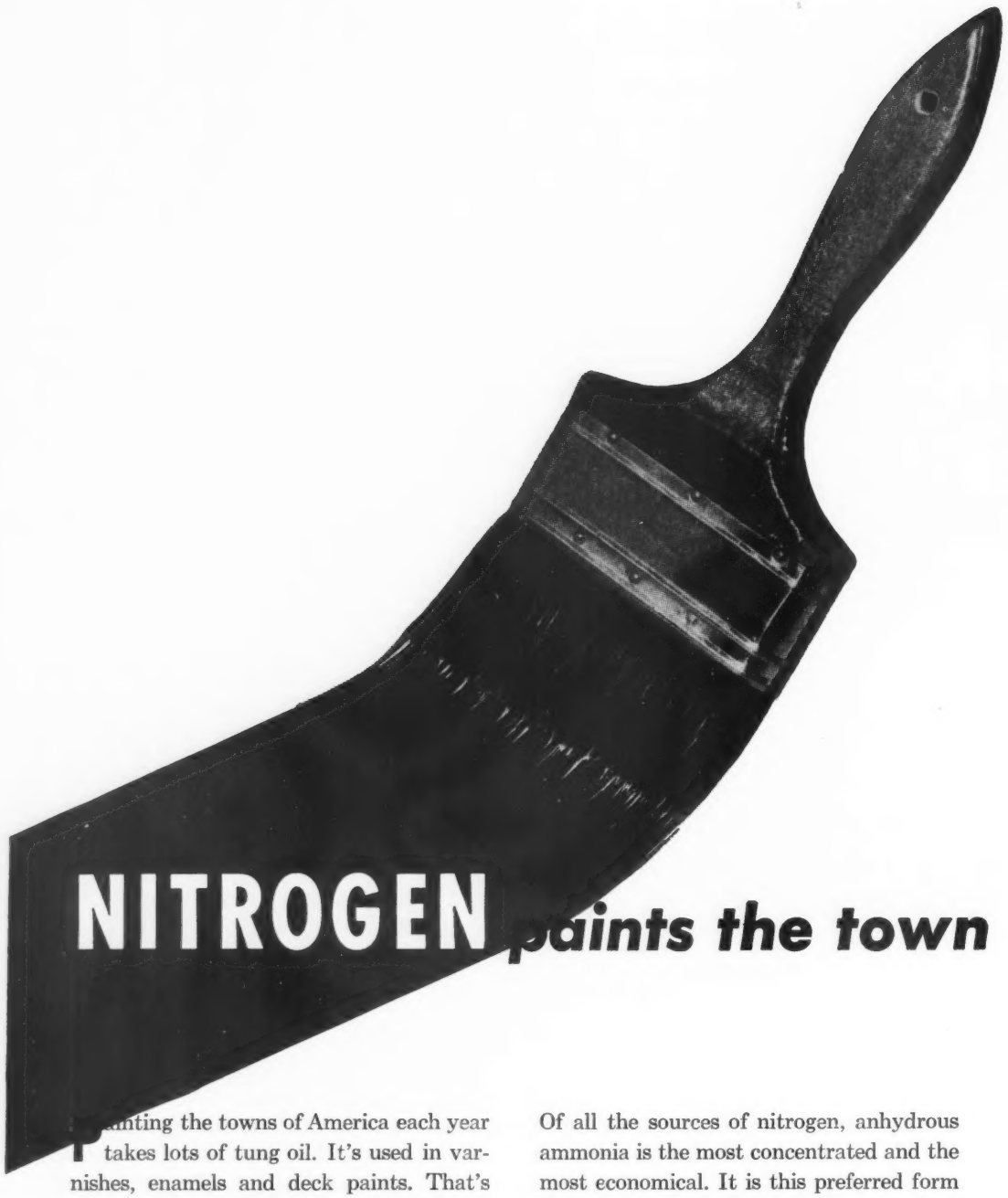

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OF A SERIES
ON HOW TO

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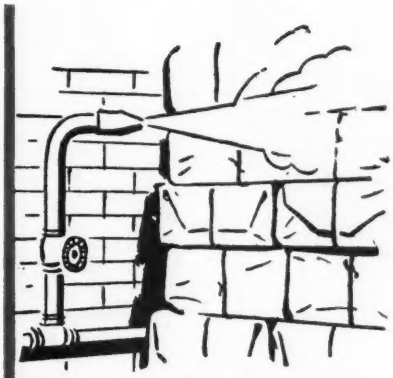
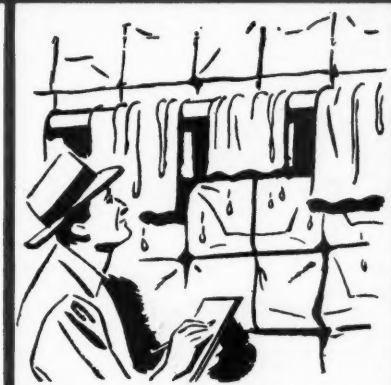


1. Let steam escape in bag storage room to keep air and bags humid. Keep a humidity indicator in the storage room and check it frequently. Always leave aisles or spaces between stacks of bags to allow circulation.

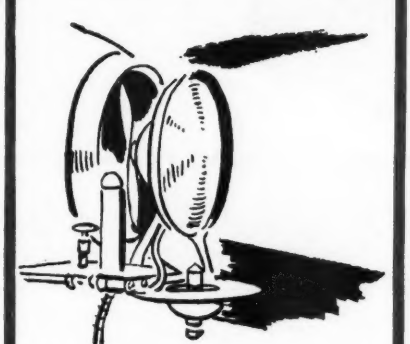
2. Store bags on dunnage, away from floor, and keep floor wet so moisture can be absorbed into air. A relative humidity of about 50% at warm temperature is best.



3. Drill small "needle" holes in horizontal water pipes. Hang cloths over holes. Air absorbs moisture from wet cloths.

4. Hang wet cloths over edge of water barrels. Cloth absorbs water and air absorbs moisture from cloth. Keep barrels well filled.

5. Open windows on damp or rainy day. Damp outside air will circulate in the bag storage room. Multiwalls are strongest when moisture content of the paper is about 6 or 7%.



6. Use commercial humidifying apparatus. Many types of commercial humidifiers are available with capacities to suit individual requirements.

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In this issue . . .

The condition of superphosphate in a fertilizer is largely responsible for the condition of the fertilizer because most grades contain at least 50 per cent superphosphate. The addition of ammonia improves the mechanical condition of superphosphate, but it is important to have a superphosphate with a low moisture content to insure good mechanical condition and to avoid reversion. Joe C. Sharp and Gordon A. Crowe, of the technical service section, Spencer Chemical Company, tell about the treatment of superphosphate with free ammonia in the article on page 14. The four principal reactions which accompany complete ammoniation of superphosphate are described in detail in the first of two articles.

How the chemical industry developed a product to fill a particular need is told in the story of toxaphene, developed by the Hercules Powder Company. Chemical industries have produced many methods of insect control through the years, but when a series of powerful insecticides was made available in 1947, farmers got real weapons for fighting insects. The story of toxaphene—its development by Hercules, its application and effectiveness—is told in the report on page 19.

Every year hundreds of men are injured and valuable man-hours are lost in chemical plants all over the country because adequate safety precautions are not taken. C. E. Killebrew, sales manager of the Frank G. Hough Company, analyses the problem of safe operation of mobile plant equipment in the first of a series of articles on plant safety. Mr. Killebrew discusses speed, governors, steering control and the problem of handling materials so that the operator is not endangered, on page 10.

Fertilizer formulas often are rewritten several times a season, depending on availability of the various materials used. Materials must be included when they are plentiful; scarce ones must be conserved. Trial and error formulating takes time and is bothersome. To simplify matters, the Charles H. Lilly Company has developed a handy method of computing key fertilizer formulas. According to the company, the difficult part of the problem is to determine what quantities of nitrogen and phosphate materials should be added to give exactly a ton of fertilizer with the desired number of pounds of available phosphoric acid. The article appears on page 22.

Costly shutdowns are eliminated and maintenance expense is reduced by using a new continuous ball or tube mill developed by the Patterson Foundry and Machine Company. The company claims the mill provides economical and reliable continuous grinding operations because it is constructed with hollow trunnions for continuous feed and discharge of materials. The mill is described and illustrated on page 48. A Reader Service Card may be filled out if further information is desired.

farm chemicals

Formerly
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Established 1894

PIONEER JOURNAL OF THE FARM CHEMICALS INDUSTRY

Vol. 114 **OCTOBER, 1951** **No. 10**

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Cover Story

There still are plenty of grasshoppers nibbling on plants like the one on the cover, but since the chemical industry developed toxaphene in 1947 the number has been greatly reduced. The Hercules Powder Company worked for more than 20 years to develop a powerful insecticide that would kill most agricultural pests and still be safe for use on livestock.

The result, toxaphene, a chlorinated camphene of terpene origin, has been found to be useful against boll weevil, cotton leafworm, aphid, thrips, ticks, lice, lygus, beetles and many other insects. In addition, tests have shown that the pesticide, when applied at rates giving satisfactory insect control, will not cause injury to a wide variety of plants and will not cause off-flavor in fruits and vegetables. The story of the widely approved pesticide is told in this issue.

—Photo courtesy Hercules Powder Company

A magazine international in scope and circulation and devoted to manufacturers, mixers, and formulators of fertilizers and pesticides

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IMPORTANT ANGLE ON FARM PRODUCTS

Everything that grows must feed. This law, as every farmer knows, applies to young plants as well as to young pigs. That is why it is important to maintain the nourishing properties of a good soil and enrich those of a poor one. One of the surest ways of reaping well-nourished, abundant crops is through the wise use of the right types of fertilizers.

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farm Chemicals facts

. . . Briefly Noted

The newly formed insecticide division at the Fort Pierce, Fla., branch of **Naco** Fertilizer Co. will be headed by **R. L. Brown.** Brown has been with the company since 1941 and was assistant manager of the Fort Pierce operations before his promotion.

Commercial quantities of **1, 2, 4, 5-Tetrachlorobenzene** are now available from the **Hooker Electrochemical** Company, Niagara Falls, N. Y. An intermediate in 2, 4, 5-T production, the material has a melting point range of 137.5–139.5° C and is sold in flake form.

Howard L. Shelly, sulfate of ammonia salesman for Bethlehem Steel Company, retired recently after 35 years of service.

Lion Oil Company has named **Douglas Kelly, Jr.,** manager of chemical sales in its western division. He served as assistant sales manager of the division before his promotion.

A new chemical manufacturing firm, **Jameson Chemical** Co., has been formed by **A. R. Jameson,** former vice-president of Velsicol Corporation. Headquarters will be in Chicago.

The bronze "Oscar of the Industry" trophy for the best annual report of any company in the chemical industry has been awarded to **Commercial Solvents** Corp. **Monsanto** Chemical Co. was runner-up in the competition and **Hooker Electrochemical** Co. placed third.

Two appointments have been announced by International Minerals and Chemical Corp. **Robert L. Logan** is process engineer and **Robert H. Berg** is process control engineer.

Stauffer Chemical Company will double its capacity for high gamma **BHC** production with completion of their new plant at Henderson, Nev. The process, developed by Stauffer's Research & Development Dept., gives a product with much less objectionable odor.

General manager of duPont's **Grasselli** Chemicals Department, **Emmet C. Thompson,** retired recently. Thompson had been with duPont 34 years, beginning as a plant manager. He is succeeded by **Clark W. Davis,** former assistant general manager.

Excellent results are reported from the **Army's** $1,300,000 insect control program carried out during the 1951 fiscal year. The project, carried out by the Corps of Engineers, resulted in a savings of $24,000,000 in buildings, grounds, equipment, and food.

T. G. Lewton, Jr., has been named West Coast sales representative of the Pittsburgh Agricultural Chemical Company, with headquarters in San Francisco. Lewton was formerly employed by the Pacific Chemical & Fertilizer Company at Honolulu.

Nitrogen solutions are being produced at the new **Commercial Solvents Corp.** Sterlington, La., plant. A second unit is scheduled to be in production by the first of the year.

Ashcraft-Wilkinson Company has opened a branch office in Columbus, Ohio, with **Warren C. Huff** as manager.

New name of Millmaster Chemical Corp. is **Berkshire Chemicals, Inc.** The company will remain at its present offices at 420 Lexington Ave., New York 17, and will continue to act as exclusive sales agents for F. W. Berk & Co., Inc.

Price reductions up to five cents per pound for Igepal non-ionic surfacants have been announced by the **Antara Products Div.,** General Dyestuff Corp.

According to an agreement signed by **Pennsylvania Salt** Co. and **Sharples Chemicals** Inc., 5.15 shares of Pennsalt common stock will be exchanged for one share of Sharples. The offer is expected to be made during the latter part of December.

New New York district manager of sales for Potash Division, International Minerals & Chemicals Corp. is **Paul W. Hiller.** Hiller was formerly manager of the products development department of Innis, Speiden & Co.

A test run by Chemical Construction Corp. at the **Meredian Fertilizer Factory,** Harriesburg, Miss., shows that triple superphosphate can be produced in Broadfield Process equipment. The process is not new but does add to the operation scope of plants equipped with Broadfield dens.

Construction of a $9,000,000 fertilizer plant for **Consolidated Mining & Smelting** Co. has begun at Kimberley, Canada. Scheduled for completion early in 1953, it will produce 70,000 tons of high analysis ammonium phosphate fertilizer per year.

Died: Frank P. Morison, 81, of Morison Brothers, Bangor, Me., fertilizer manufacturers.

Sulfur is being produced from natural gas supplied by Pure Oil Co. at a **Texas Gulf Sulphur** plant in Worland, Wyo. **C. O. Stephens,** plant manager, reports that the project has a daily capacity of 400 tons but is currently producing only 300 tons.

A decision is expected soon on the proposed lease of the Morgantown, W. Va., Ordnance Plant to **Mathieson** Chemical Corp. The House Armed Services Procurement Subcommittee is investigating charges of Army favoritism in awarding the lease. United Distillers of America, Inc., has contended that Mathieson is technically unprepared to operate the nitrogen plant and that the Army used an undisclosed formula in awarding the lease.

A contract between **International Minerals & Chemical** Corp. and shareholders of the **Hoover & Mason Phosphate** Co. provides for the acquisition by International of the H & M outstanding capital stock. An exchange of International common shares will be made for those of Hoover and Mason.

Stockholders of **Mathieson** Chemical Corp. and **Mathieson Hydrocarbon Chemical** Corp. have been sent a plan calling for merger of the two firms. Separate meetings will be held for stockholders of both companies near the end of November.

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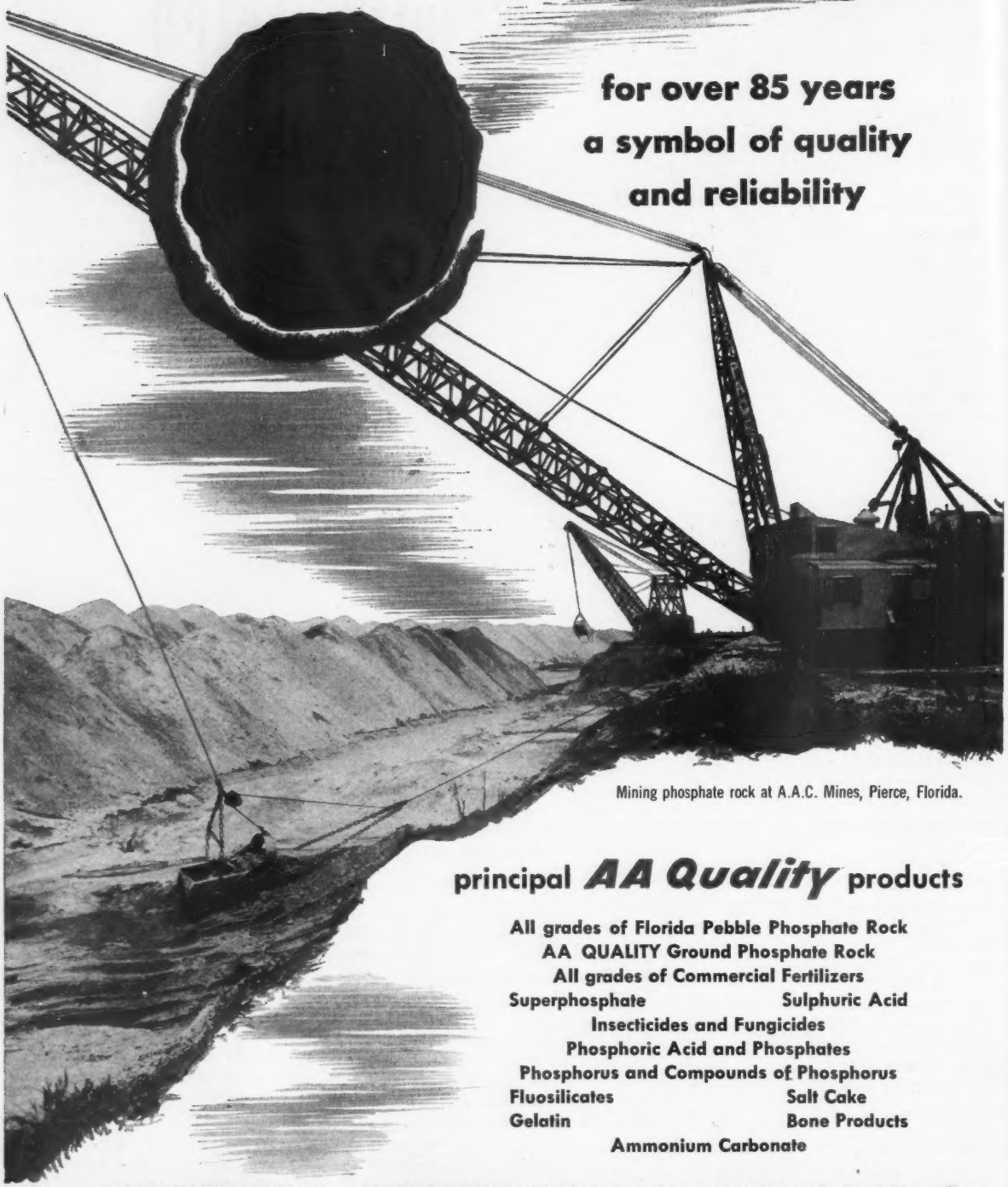

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guest editorial

Still No Tolerances

Much of the present concern over pesticides and food stems from the fact that the Food and Drug Administration has not exercised its full authority to establish and enforce tolerances on fruits and vegetables. Until that authority is put to work, the adequacy or inadequacy of protection for the public has not been fully tested.

It has been argued that insufficient toxicity and residue data is available on pesticides to enable the Food and Drug Administration to prove in a court of law that a residue is injurious. The Food and Drug Administration need not assume the burden of proof.

The industry has urged the Food and Drug Administration to establish tolerances on fruits and vegetables and actively aided that agency in procuring the 25,000 pages of expert testimony and exhibits upon which to base the tolerances on fresh fruits and vegetables.

After tolerances have been established on certain pesticides, any other pesticide appearing in the foods could, under the present legislation, be considered an adulteration and the foods could be seized—if tolerances were established on those foods.

So far the Delaney Committee has made no proposals to Congress but the Food and Drug Administration submitted proposed changes to the Delaney Committee. In substance, these proposals are the same as the so-called Miller Bill (H.R. 3257) introduced into Congress by a member of the Delaney Committee.

The Miller Bill would cause sweeping changes in the present legal structure and would give to the Food and Drug Administration jurisdiction over fertilizers, pesticides and chemical additives—a dangerous situation in itself. The bill does not consider present procedures; nor does it recognize the authority of existing legislation.

The bill would impose the same pattern of regulatory control over the three types of chemicals; although the problems incident to their use are entirely dissimilar. The manufacturer could be required to submit application to the Food and Drug Administration although the same chemical had received clearance by another manufacturer.

The Food and Drug Administration would be able to regulate the amount and nature of testing required on each chemical. The bill could be interpreted to require such unrealistic pre-testing of a product, that the cost of research alone, would prohibit the introduction of a new product and finally stop all advancement in the field of agricultural chemicals.

The pesticides industry could not possibly subscribe to legislation permitting such autocratic authority by one agency nor could manufacturers be expected to invest the huge sums necessary to search out and develop a new product against the risk of its acceptance under such unrealistic legislation.

The success or failure of any legislation is greatly dependent upon the spirit in which affected parties strive to preserve the intent of the law. A look at the record of the agricultural chemicals industry shows that there has been no attempt to violate or circumvent the authority or intent of either the Federal Insecticide, Fungicide and Rodenticide Act nor the Food, Drug and Cosmetic Act. On the contrary, there has been a concerted effort to preserve and further their intent.

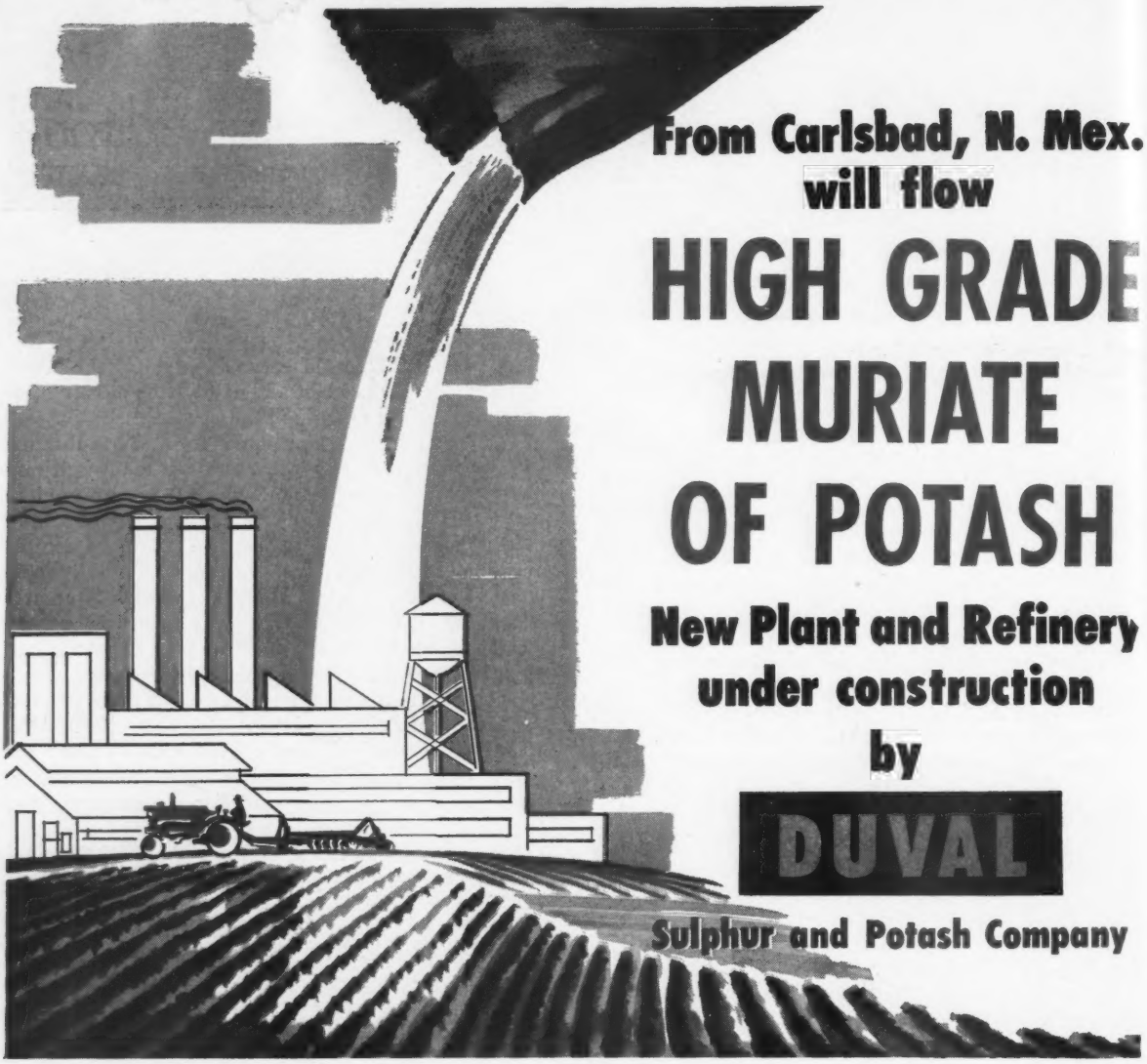
When USDA issued a directive that DDT should not be used on dairy animals, in dairy barns or that DDT-treated feed should not be used for dairy animals or for fattening beef, the industry promptly accepted the directive. At great cost and inconvenience, the manufacturers altered their labels at a period of the year when a large portion of the season's supplies was already packaged and labeled.

The mutual respect, cooperation and understanding that has grown between USDA and industry is no casual relationship to be lightly brushed aside; it is the result of two factions working toward a single, mutually-satisfactory and necessary program of operation. The pesticides industry believes that officials of USDA have served the public remarkably well without interfering with progress in research and development.

Through their publications and by contact, the pesticides industry has urged the Food and Drug Administration to issue residue tolerances and will continue to do so. That agency received the full cooperation of the industry in the compilation of evidence upon which to base the tolerances. Both government and industry spent large sums to collect from experts the best information available.

The compiled information is now under study, and the issuance of a tentative order for proposed tolerances is expected soon; but until this order is released, the Food and Drug Administration has not accepted its full responsibility—neither to the public, to the industry nor to agriculture.

—Val E. Weyl, Editor, *NAC News*



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farm chemicals outlook

Report from Washington
by Fred Bailey & Don Lerch

Fertilizer and pesticide industries are being seated at Washington's "second table." Every courtesy is being extended . . . but the servings are small compared with those in more favorable positions.

Armament production will take increasingly larger bites of critical materials. More plants are tooled for assembly-line production.

The Army is being pressured to make decisions on models and devices. While the Army is not in full agreement, indications are more finished weapons will soon be rolling out of factories.

Progress of scientific development will have a decided effect on the actual volume of armament production. Hence, supplies of critical materials available for other claimants is expected to fluctuate widely.

Industries serving agriculture can expect mounting difficulties in their efforts to supply essential farm needs. As the military take increases, the battle for leftovers will become more intense.

Congress can be expected to keep mobilizers on the spot . . . keep them renewing their pledges to consider agriculture's needs as essential. The power to allocate has been delegated to the White House, however. Congress can prevent a "famine" . . . can't guarantee a "feast", in the opinion of informed observers.

USDA officials are not giving up . . . they will fight for increases despite some recent cuts. New men are being assigned by the Department to follow the "paper allocations" through to the finished materials . . . and assure delivery to the proper companies.

Alfred Kreitzer, one of USDA's special expediters, is camping on steel mills to get the legal limit through the rolls and laid down at factory sites of nitrogen producers. He has a reputation for getting a job done.

USDA officials are becoming increasingly worried over the lack of steel for nitrogen expansion. Some estimate the current rate of new construction at less than half that originally planned. Industry has demonstrated its willingness to expand at top speed. So far, the mobilizers have not kept their part of the bargain, in the opinion of some USDA officials.

Unless top mobilizers alter their decisions on steel allocations and other essential materials needed for expansion, the Department does not see anywhere near 600 thousand tons more nitrogen for 1953. Furthermore, some Department planners say the need for nitrogen by that time will be up another 100 thousand tons.

Situation is so critical that the Department is taking steel from some other projects and channeling it to the nitrogen industry. Amounts involved, however, are reported as "token."

Industry sources are fearful that Washington confusion will seriously hinder their record of continuously increasing the supply of fertilizer materials for farmers. For thirteen consecutive years, farmers have used more fertilizer than the year before, according to USDA estimates.

In spite of certain shortages of basic materials, fertilizer supplies were an estimated 18 per cent greater during the fertilizer year, ending this June, than during the previous year. Last year's increase in the use of nitrogen was 25 per cent, phosphate 8 per cent, and potash 28 per cent.

Size of increases in production capacity can be approximated by considering the tremendous increase in fertilizer use during the past 15 years. Farm consumption during the last fertilizer year is estimated by the Department at more than three times (340 per cent) of the 1935-39 average.

Washington considers the sulphur shortage as a major factor limiting fertilizer supplies for the 1952 farm production season. While the immediate effects apply only to superphosphate, there is concern over the results of possible shifts in analysis of mixed goods reaching farmers.

Sulphur allocations have "died a thousand deaths". Washington has been in a state of jitters over "momentary announcement" for months. Some observers here say the mobilizers have perfected the old army game of "passing the buck".

A two to three-year sulphur shortage is officially predicted. Only immediate source of relief is to reduce exports . . . generally considered unlikely, at least to the extent of materially easing the situation. Exports are taking about one-fourth of U. S. production.

Extent of the sulphur shortage is conservatively estimated at a half million tons per year for at least two years. Others believe the deficit will run closer to a million tons per year.

Prospect of up to 10 per cent less sulfur, plus reduced inventories, gives industry a double problem. Responsibility for any shortages is not at industry's doorstep, according to recent Congressional testimony.

Failure of the Food and Drug Administration to issue residue tolerances for fresh fruits and vegetables is of major concern to many pesticide producers. Some 25,000 pages of testimony and exhibits were presented by witnesses representing agriculture and industry. The hearings began in January, 1950, and continued through the following September.

Most industry spokesmen believe the tolerances will be issued too late to be effective for 1952 production. Many agricultural colleges are completing official recommendations for next year's spray program.

Industry's case before the Delaney investigating committee, that present laws protect the public, would be bolstered by the issuance of tolerances in the consensus of opinion here. The long delay is creating mounting problems for the industry, food processors and growers.

Pesticide use on the West Coast is being scheduled for thorough examination by the Delaney Committee. Barring emergencies in Washington, committee members plan an on-the-spot investigation including hearings in five cities: Pullman, Spokane, Seattle, Wenachee, San Francisco and Los Angeles.

There is a new clue in the mystery of declining corn borer losses. The evidence, while somewhat circumstantial, points to an imported parasite similar in appearance to the common housefly. Latest reports from Iowa and Illinois show that in some areas 100 per cent of the borers have been killed by the fly. Kills ranging from 40 to 60 per cent in the Corn Belt this year are common.

Entomologists are uncertain how to divide the credit between the parasite and the weather. Many believe the parasite to be a very important factor.

Twenty-two species of parasites were imported into the U. S. by the Bureau of Entomology beginning in 1920. Results since then have been mixed. If the parasite proves to be a major controlling factor, then the total investment of a half-million dollars by the Bureau would be repaid many fold in a single year.

You can't depend on the parasites to control the borer . . . say the entomologists. Farmers are being advised to hold onto their spray guns. Will keep you advised of developments.

Supplies of lead arsenate, of primary importance to fruit growers, may be extremely short unless the government takes immediate action. Some producers are reported not receiving sufficient supplies of lead to maintain operations. Price limit on imports is expected to reduce further supplies available for agriculture. A third of total U. S. consumption is normally imported.

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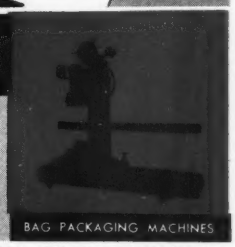
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Safe Operation of Equipment

Responsibility in farm chemicals plants is spread across all jobs from operator of mobile machinery to top management

By C. E. Killebrew,
Sales Manager, The Frank G. Hough Company

SAFE OPERATION of mobile plant equipment is a challenge to the manufacturer, the machine owner, the operator's supervisor and the operator himself. Responsibility is widely spread yet closely related. The reason for this review is to give you an idea of how we and other manufacturers try to arrive at suitable answers to problems.

The original transmission high gear speed in Hough machines was a top of 16 mph in reverse. Much to our surprise in every plant we were told the unit must be slowed down, speed was too dangerous.

Our reply was that there were two speed ranges and a foot accelerator, so in effect the speed was anything from 1 mph to 16 mph and the operator could control the unit to fit the job. We drew a comparison to automobiles, some of which will go 100 mph, but even though they can, most people drive 60 to 65 out on the road and much less around sharp curves and in congested traffic.

We were told all we were saying was quite true, but did not apply to mobile plant equipment. Mobile plant equipment it seems has only one speed and that is high gear—wide open throttle.

As a result, the top speed forward was reduced to about 7 mph and top speed reverse to about 10 to 11 mph. Perhaps all of us would agree that this would enforce safety to some extent much the same as if 50 mph top speed was the limit for automobiles.

On the other hand, some of you would probably agree the machines are still too fast—others would like to see faster travel on long, straight hauls in wide aisles.

As a matter of safety, some plants have removed the speed range lever and have the unit locked in low range giving 2.9 mph forward and 4.75 mph reverse. This usually applies to car work only and where there is a narrow platform.

In some plants, we find units operating at speeds well over the specification speed. It is done by disconnecting the governor. The resulting excessive

This man is wearing a good set of wide visibility goggles. They protect his eyes from dust and dirt

The operator is working in an extremely dusty area. He should have a set of goggles and a respirator

engine speed will seriously affect hydraulic pump life and engine life. We use a rotary vane type pump on the Model HA and its critical speed is about 1,900 rpm. We use gear pumps where engine speeds are 2,000 rpm to 2,200 rpm.

All manufacturers would certainly agree that governors should not be tampered with.

It seems to us that higher speeds should be built into units for the benefit of people who can safely use them so we are at it again. The new Model HAH with four forward and four reverse speeds up to 28 mph and on a reasonably smooth surface handles nicely at that speed—returning empty. Those who desire to do so can lock out 4th gear, giving a top of 12 to 13 mph in 3rd or lock out 3rd and 4th gears, giving a top of about 7 mph in second gear.

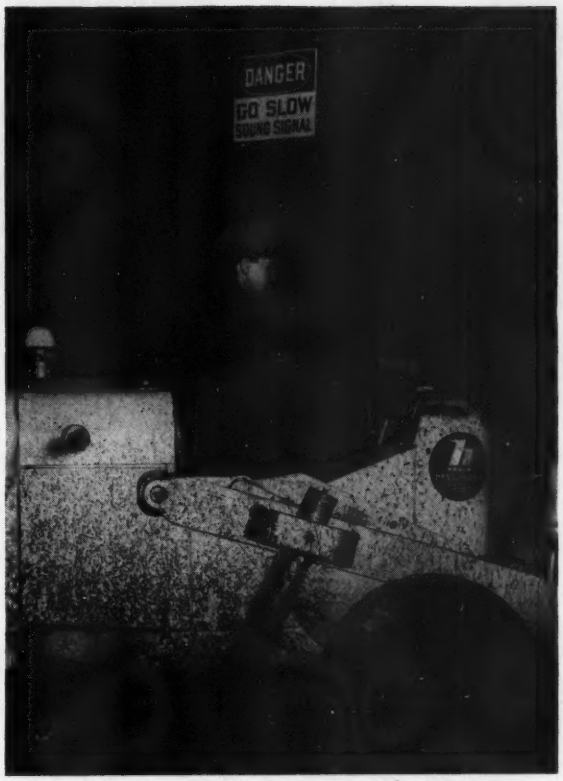
Before leaving the speed topic, I would like to say that there are two reasons for higher reverse speeds. First, a crowding action in the face of the pile is required for loading the bucket. The engine power through a higher gear ratio (slower speed) gives that.

In reverse the power is converted into speed for a fast working cycle, also higher travel speeds in reverse —particularly with a load gives the operator better control if he has to stop suddenly. The machine retains its stability whereas a quick stop going forward makes the machine stand on its nose. Also in fast travel in reverse, dust from the bucket blows away from the operator instead of in his face and eyes.

As in nearly all cases there are exceptions—on sloping ramps, the bucket should always be on the up-hill end of the machine. Go forward up ramps and back down them.

Brakes seem adequate if properly maintained. Offhand, I do not know how they could be measurably improved. Any manufacturer is certainly open to suggestions. Schools are being held in an effort to improve all phases of maintenance.

Steering control is a safety "must." I am amazed to see operators travel at high speed with a half turn of slack in the steering wheel. There are only two simple adjustments in the steering housing and tie rod



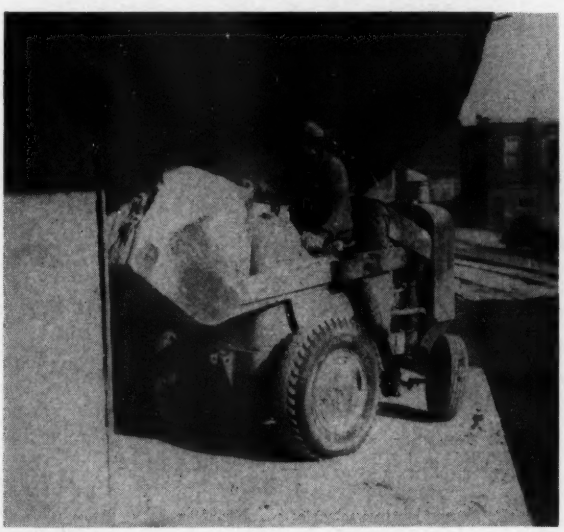
The large clear sign warns the driver of a dangerous area. More signs like it would help promote safety

ends can be easily replaced. The bushings can be replaced in the bell crank when needed. These points should be looked after more closely. A good lubrication program will extend the life of the parts.

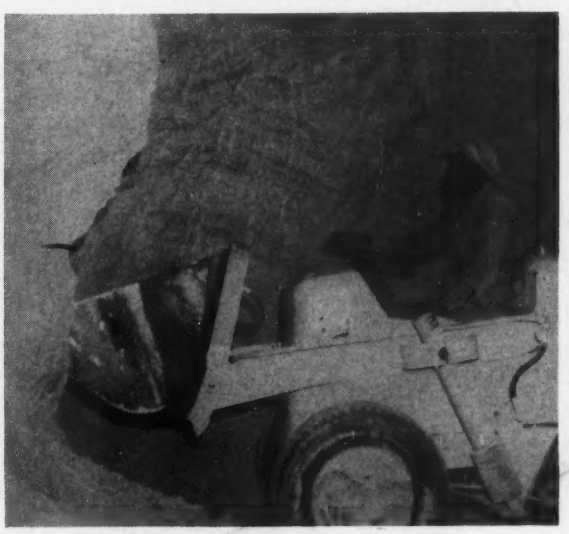
There are a number of safety items associated with fuel, fuel supply, carburetors, oilbath air cleaners, etc.

Some machines have been observed in operation with dirty rags in the gasoline filler pipes instead of the regular caps. The results—fire hazards, dirty fuel, dirty carburetors and inefficient combustion and leak-

Tail swing of this machine almost causes operator to run off the dock. He should have more clearance



Note operator's concern while undercutting the pile. This is a dangerous practice and can cause injury



ing carburetor bowls, due to sticking floats. Underwriters Laboratory fire preventive attachments can be supplied upon request. Usually the items consist of a protectoseal type gas filler cap and either a water muffler or dry type spark arrestor.

While both the water muffler type and dry type are approved, the water muffler is not completely effective if permitted to run dry and is subject to ice hazards if stored in unheated buildings in sub-freezing temperatures.

While considering the fire control category, it is well to cover good maintenance on fuse blocks, terminals, wiring harnesses and battery tie down fittings, all of which can cause a fire. Another item is the careless use of light bulbs or heating elements under the hood during overnight storage. It is a type of condensation control and an aid to starting the next morning, but should be handled carefully because of the fire hazard.

On the air intake side—most people usually think of the oilbath air cleaner as the name would apply—just an air cleaner. It is far more than that and can cause lots of trouble if improperly handled.

It is, of course, an air cleaner when properly serviced, but equally as important, it is an Underwriters approved type of backfire arrestor. Its effectiveness fails completely as a cleaner and fire protection agent if not serviced.

There is one further and equally serious consideration. If the stack becomes clogged, preventing the free flow of air, the result is the same as running the engine with the choke on.

It is bad enough that the result is crankcase dilution, rapid ring, piston, bearing and cylinder wear, and high fuel consumption. It is even worse when the operator and perhaps others pass out, because of the carbon monoxide and other poisonous gases thrown off from the engine, due to inefficient combustion. An efficient fuel air ratio adjustment at the carburetor is not possible if there are obstructions at other points.

Low cubic displacement internal combustion engines do not create toxic gases in excess of safe limits where combustion is clean and complete as in engines in good repair and adjustment.

Head injuries result from low head room like this. Also the car-to-dock plate should be full car width

I have mentioned only one phase of combustion control. Other phases are compression ratio, condition of spark plugs, fuel quality, etc.

A good program of preventive maintenance is, therefore, essential to operating safety.

In some plants a definite safety aid would include adequate lighting, and more effective dust control. An example of dust control is shown in one of the pictures on display.

In some plants we observe bin partitions in questionable repair and tie bars or cross braces too low to permit the operator to get under without ducking. Operators have suffered injuries by striking their heads on cross braces. One operator fatality resulted when he tried to reach the bucket under a dock only steering wheel height. His foot slipped off the clutch and he was pinned between the machine and dock.

One illustration shows an operator who has dug under a pile. The picture was snapped as the operator was looking up, seemingly expecting the pile to come down on him any second. This is a dangerous practice. The pile should be "shot". A loose pile is easier to work, a higher rate of production will result and it is easier on the machine.

Don't overload machines!

Operator should climb on and off machine only when bucket is on ground.

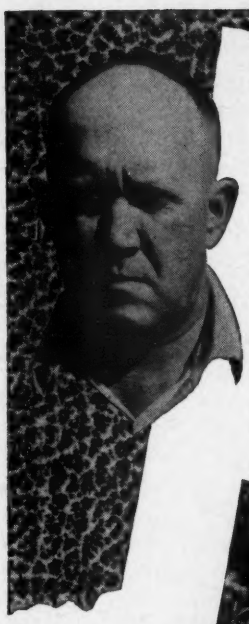
A higher rate of production and greater safety will result from the use of better quality plates to go between dock and car. We see cases of machines that are damaged, operators injured and work stoppage resulting from plates slipping and dropping the machine wheels between car and dock. We also find cases of docks in questionable repair.

In the garage area we see men working in and around machines without sufficient safety precautions —a unit supported on a chain hoist without safety blocks below; working under bucket without safety measures. Many injuries have resulted from buckets being lowered on men working down in front of the machine.

It seems that individual plant managers and superintendents should establish their own code of safety regulations to fit plant conditions. We favor regulation stops or speed regulations at dangerous intersections. Drivers must be forced to adhere to the established rules. Operators must be cautioned not to carry the bucket too high thus raising the center of gravity, which will result in overturning the machines.

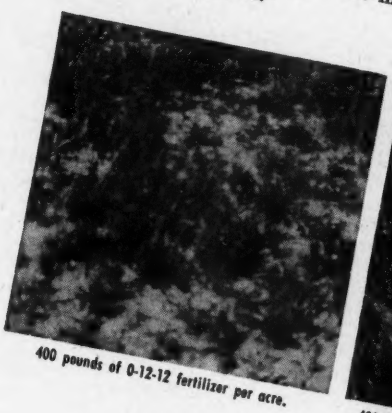
Where the operator dumps into a large pit or hopper, heavy timbers should be installed to stop the machine, providing the operator fails to stop. Injuries have resulted where drivers have driven through the ends of buildings, off loading docks, off ship docks, or into hoppers.

Operator supervision is and has been a problem, however, in over 17 years of experience I have yet to see a man who did not genuinely enjoy operating his machine. For this reason I think plant traffic rules can be enforced by threatening to remove a man from his machine if he repeats infractions of rules. ◆

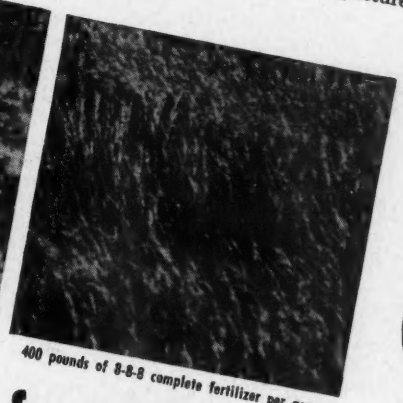


Pastures treated with 8-8-8 carried 30% more cattle for Beryl Wayt, Michigantown, Ind.

"I applied 8-8-8 at the rate of 400 pounds per acre on 25 acres of Big English bluegrass and ladino clover," says Mr. Wayt. "I also applied 400 pounds of 0-12-12 on 10 acres of the same mixture. The pasture treated with 8-8-8 carried 30 per cent more cattle per acre than the pasture treated with 0-12-12."



400 pounds of 0-12-12 fertilizer per acre.



400 pounds of 8-8-8 complete fertilizer per acre.

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the chemistry of

Ammoniated Superphosphate

Joe C. Sharp and Gordon A. Crowe

Spencer Chemical Company

TREATMENT of superphosphate with free ammonia serves a double purpose in fertilizer manufacture. The ammonia acts as a conditioner for the superphosphate and the latter in turn functions as a neutralizing agent for the ammonia and thus eliminates the expense incident to the conversion of this source of nitrogen into a form suited for direct use as a fertilizer.

The complete ammoniation of ordinary superphosphate is accompanied by four principal reactions which may be represented as follows:

1. $H_3PO_4 + NH_3 = NH_4H_2PO_4$
2. $Ca(H_2PO_4)_2H_2O + NH_3 = CaHPO_4 + NH_4H_2PO_4 + H_2O$
3. $NH_4H_2PO_4 + CaSO_4 + NH_3 = CaHPO_4 + (NH_4)_2SO_4$
4. $2CaHPO_4 + CaSO_4 + 2NH_3 = Ca_3(PO_4)_2 + (NH_4)2SO_4$

Up to 2.3 pounds of ammonia per unit of P_2O_5, the mono-calcium phosphate reacts to form mono-ammonium phosphate and di-calcium phosphate. The manner of ammonia introduction and subsequent treatment does not influence this reaction and no loss of available P_2O_5 occurs.

The rapid introduction of from 2.3 to 6 pounds ammonia per unit of P_2O_5 with no control of temperature or moisture results in several reactions occurring to some extent simultaneously, with di-calcium phosphate disappearing more rapidly than the mono-ammonium phosphate.

Up to 4 or 4.5 pounds of ammonia per unit P_2O_5, the temperature during ammoniation is between 70° and 90° C., and the first major reaction apparently involves di-calcium phosphate, calcium sulfate and ammonia, forming tri-calcium phosphate and water. As this progresses and more ammonia is absorbed the temperature gradually rises, and at the higher temperatures (90° to 100° C.) the mono-ammonium phosphate reaction is accelerated.

By the time the di-calcium phosphate has all reacted the mono-ammonium phosphate reacts with calcium sulfate and ammonia to form ammonium sulfate and more di-calcium phosphate and water.

Di-calcium phosphate so formed may subsequently react with calcium sulfate and ammonia to form tri-calcium phosphate and water, but from an analytical study of the precipitated phosphate material it apparently remains largely as di-calcium phosphate intimately mixed with the more di-basic compounds.

Triple Super

Triple superphosphate differs from ordinary superphosphate in that it contains only a small amount of calcium sulfate—usually less than 3 per cent.

The different steps in the absorption of ammonia by triple superphosphate at a temperature above that at which di-calcium phosphate will undergo ammoniation may be represented as follows (9):

5. $H_3PO_4 + NH_3 = NH_4H_2PO_4$
6. $Ca(H_2PO_4)_2H_2O + NH_3 = CaHPO_4 + NH_4H_2PO_4 + H_2O$
7. $2CaHPO_4 + CaSO_4 + 2NH_3 = Ca_3(PO_4)_2 + (NH_4)_2SO_4$
8. $NH_4H_2PO_4 + NH_3 = (NH_4)_2HPO_4$
9. $3CaHPO_4 + 2NH_3 = Ca_3(PO_4)_2 + (NH_4)_2HPO_4$

When triple-superphosphate is treated with increasing amounts of ammonia at 100° C. in a closed vessel, the mono-calcium phosphate is completely changed into di-calcium phosphate, if the ammonia absorbed amounts to about 2.8 pounds for each unit P_2O_5.

Additional Ammonia

A further addition of ammonia leads to the formation of a small quantity of tri-calcium phosphate by reacting with calcium sulfate and a portion of di-calcium present.

No further increase in tri-calcium phosphate takes place until the ammonia absorbed is in excess of 5.9 pounds for each unit P_2O_5. The maximum quantity of ammonia that the material is theoretically capable of absorbing when ammoniated at 100° C. in a closed system is 7.3 pounds of ammonia for each unit P_2O_5. The maximum found by repeated treatments with ammonia is about 7 pounds for each unit P_2O_5.

The capacity of superphosphate to combine with free ammonia has

definite limits. In the manufacture of many grades of mixed fertilizer, it has been necessary to supplement anhydrous with more costly nitrogen materials. This led, beginning in 1933, to the production of ammoniating solutions.

From the first, the solutions proved substantially cheaper, per unit of nitrogen, than solid chemicals. Moreover, compared with anhydrous, the solutions permitted more total nitrogen to be obtained without increasing the free ammonia content. These solutions, having high vapor pressures, lose ammonia readily at atmospheric pressure.

Let us examine some interesting figures which apply to solution D described in table 1. The average chemical composition is 34 per cent ammonia, 6 per cent water, and 60 per cent ammonium nitrate. The specific gravity is 1.033 at 95° F.

Assume that two pounds of ammonia are lost per 100 pounds of original solution. This loss may occur during transfer if the solution is placed in storage, or during mixing if the measuring tank is vented. The solution will then contain:

32 pounds ammonia	=	32.7%
6 pounds water	=	6.1
60 pounds ammonium nitrate	=	61.2
98 pounds Total		100.0%

The analysis of the original solution is 49 per cent nitrogen. The analysis of the new solution is 48.4 per cent nitrogen. The specific gravity of the new solution at 95° F. is 1.045. Since the density of the new solution is higher than that of the original solution, one inch on the gauge glass now represents more pounds than anticipated.

Mixed Operator

The mixer operator measures inches rather than pounds. Consequently, the analysis of the new solution (48.4 per cent) may be multiplied by the ratio of the specific gravities (1.045/1.033) to give an effective analysis of 48.9 per cent nitrogen. In other words, the new solution is of lower analysis than the original solution, but there are more pounds per inch of gauge glass.

The magnitudes of the compensating errors are such that they almost precisely counter-balance each other to yield a mixed fertilizer of the proper grade. We assumed a loss of two pounds of ammonia per 100 pounds of solution. The actual loss of weights is 2 per cent. The shortage reported by the operator, however, will be 2 (1.045/1.033) which is 3 per cent The apparent loss is one and one-half times the actual loss.

Urea Ammonia Solutions

Lundstrom and Whittaker (6) found that the heat developed during the ammoniation of superphosphate, or mixtures containing it, may cause the urea present to decompose or hydrolyze by reacting with various substances if temperatures in excess of 50° C. are maintained for several days.

The CO_2 formed during the decomposition escapes from the mixture, but the ammonia is in general retained by the acidic constituents except at prolonged high temperatures. Only 4 to 8 per cent of the urea was decomposed on heating a urea-superphosphate at 60° C. for 100 hours, but excessive decomposition occurred at 80° C. and all the urea was hydrolyzed after a few hours at 100° C.

The study of urea-phosphate in the mixture of urea with individual components of superphosphate indicated that the hydrolysis of urea occurs by reacting with free moisture, water of composition, or water of constitution of mono-calcium phosphate, di-calcium phosphate or phosphoric acid. Ammonium sulfate, calcium sulfate and tri-calcium phosphate were found to have little or no effect on urea hydrolysis.

Experiments on decomposition of urea in complete fertilizers show that some slight decomposition may occur on prolonged heating at temperatures as low as 45° C. In one sample complete decomposition occurred on heating four weeks at 65° C. More than 50 per cent of the urea in all samples decomposed the first week at 85° C.

Double decomposition reactions occur between ammonium nitrate and other compounds present that do not contain either ammonium ions or nitrate ions. Ammonium nitrate reacts with potassium chloride to form ammonium chloride and potassium nitrate, and with calcium sulfate to form ammonium sulfate and calcium nitrate. Also double salts are formed such as $(NH_4)_2 SO_4 . 2NH_4 NO_3$.

Keenen and Morgan (5) found two principal reactions occurred during the storage of ammoniated mixed fertilizers containing dolomite under commercial conditions. Dolomite reacted with mono-ammonium phosphate converting a portion of it to di-ammonium phosphate, substantially reducing water soluble P_2O_5 but not causing loss of available P_2O_5.

Secondary reactions involving di-ammonium phosphate, calcium sulfate, and di-calcium phosphate caused loss of available P_2O_5. The rates of reactions were primarily dependent upon temperature and were doubled for each 13° C. rise. They were so slow at below 43° C. as to be of no significance under six months storage.

Loss of available P_2O_5 was proportional to time, storage temperature, degree of ammoniation and concentration of P_2O_5. Quantity of dolomite was of little importance, since 75 to 100 pounds per ton sufficed for complete reaction of mono-ammonium phosphate in 8 to 10 per cent P_2O_5 fertilizer, and non-acid-forming mixtures contained a great deal more than that. These reactions may be expressed by equations X and XI:

10. $3NH_4H_2PO_4 + CaCO_3MgCO_3 = CaHPO_4 + MgNH_4PO_4 + (NH_4)_2HPO_4 + CO_2 + H_2O$
11. $2(NH_4)_2HPO_4 + 2CaHPO_4 + CaSO_4 = (NH_4)_2SO_4 + Ca_3(PO_4)_2 + 2NH_4H_2PO_4$

Ammonia Absorption

Keenen (4) made experiments in five widely separated fertilizer mixing plants to determine the maximum amount of anhydrous ammonia that could be successfully introduced under normal operating conditions.

Small scale experiments had shown that the chemical absorption limit was 5 to 5.5 per cent nitrogen, but five to eight minutes in a relatively tightly enclosed mixer were required for complete absorption of the maximum quantity using anhydrous ammonia. The use of aqua

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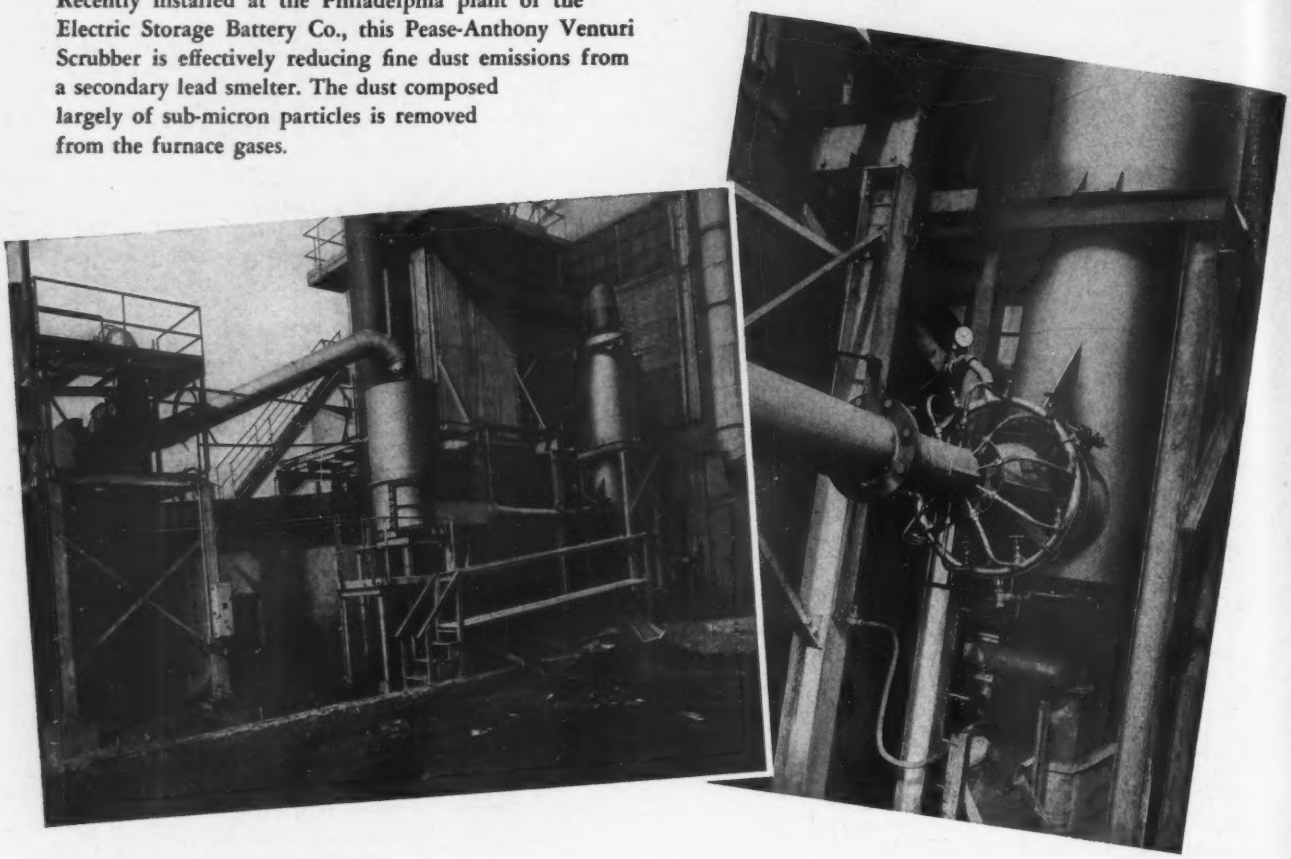
Recently installed at the Philadelphia plant of the Electric Storage Battery Co., this Pease-Anthony Venturi Scrubber is effectively reducing fine dust emissions from a secondary lead smelter. The dust composed largely of sub-micron particles is removed from the furnace gases.



Other Typical Applications

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APPLICATION	MATERIALS BEING REMOVED	DUST AND FUME LOADINGS Inlet to Scrubber	Outlet from Scrubber
DUSTS			
Diatomaceous Earth Plant	Diatomaceous Earth	1.2 grains/scf	0.05 grains/scf
Rubber Blenders	Carbon Black	0.3 grains/scf	0.003 grains/scf
Yellow Brass Foundry Furnace	Zinc Oxide	3.5-10 grains/scf	0.7 grains/scf
Lime Kilns	Lime and Na_2O Fumes	7.0 grains/scf	0.02 grains/scf
Electric Furnace Fumes	Iron Oxide	0.2 grains/scf	0.03 grains/scf
Blast Furnace	Iron Oxide	4.0-20.0 grains/scf	0.008-0.08 grains/scf
Secondary Lead Blast Furnace	Lead and Rubber Compounds	1-10 grains/scf	0.05-0.20 grains/scf
FUMES			
Copperas Roasting Plant	H_2SO_4 Mist	100-300 Mg/scf	1-5 Mg/scf
Titanium Plant	H_2SO_4 Mist	120 Mg/scf	2.0 Mg/scf
Phosphoric Acid Plant	H_3PO_4 Mist	100-300 Mg/scf	3.0 Mg/scf
Wood Distillation	Tar Fog and Acetic Acid Mist	1000 Mg/scf	10-40 Mg/scf
Enamel Smelting Furnace	Dust and Fluoride Fumes	55.0 Mg/scf	4.0 Mg/scf
Dry Ice Plant	Amine Fog	25.0 Mg/scf	5.0 Mg/scf

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made it possible to add an equivalent amount in a shorter time, but the water so introduced caused excessive dampness in the mixture when more than 2.5 per cent N was added to the superphosphate.

Potential Reversion

Potential reversion of phosphate has been found to be practically independent of the moisture content of the goods as long as the moisture is above 6 per cent. Therefore, the reversion at a given degree of ammoniation is the same with aqua as with anhydrous.

The factory tests included mixed goods, and cured and fresh superphosphates from Tennessee and Florida rock sources. The mixers were ordinary rotary batch machines of the Sturtevant or Stedman type. It was found that 3.5 per cent N was an average maximum limit of ammoniation with anhydrous ammonia.

The limit is sharply defined for a given material and attempts to introduce more than this amount of ammonia within three to four minutes resulted in excessive losses. The condition of the superphosphate and the presence of other ingredients in mixtures had relatively little effect upon this limit, although it varied as much as 0.5 per cent N between different plants.

The highly ammoniated mixed goods were comparable to ordinary ammoniated materials in physical characteristics, but showed even less tendency to cake and were generally in dryer condition.

Recording Thermometer

A recording thermometer buried in a pile of highly ammoniated goods showed a tendency in mixed goods to rise 2° to 4° C. the first 24 to 36 hours in the storage pile. No such tendency was noted in straight ammoniated superphosphate.

The ammoniation temperatures using 3.5 per cent N were on the order of 90° C. for straight superphosphate and 70° C. for mixed fertilizers. The difference in behavior previously mentioned is thought to be due to this variation in initial temperatures.

Equilibrium

Time required to reach equilibrium, five days at 80° C. to 28 days at 60° C., is probably entirely dependent upon temperatures, as free moisture was clearly present at each temperature. Reduction of the temperature to 40° C. or below brings in another factor—combination of free water into hydrates stable at ordinary temperatures.

Detailed observation of results in various fertilizer plants during the past three years has shown that the final equilibrium in goods ammoniated sufficiently to show significant

Table 1.
Composition and Properties of Commercial Ammoniating Liquids

	Per Cent by Weight			Per Cent Nitrogen (3)				Sp. Gr. at 60° F. (4)	Vapor Pressure psi Gage 104° F. (4)	Salting Out Temp. ° F. (4)
	Salt	Ammonia	Ammon. Carbamate	Water	Total	Nitrate	Ammonia			
NH_4NO_3-NH_3 (1)										
Type D.....	60.0	34.0	....	6.0	49.0	10.5	38.5	1.042	50	—52
B.....	55.5	26.0	....	18.5	40.8	9.62	31.18	1.079	16	—13
A.....	65.0	21.7	....	13.3	40.6	11.36	29.24	1.142	10	23
C.....	66.8	16.6	....	16.6	37.0	11.65	25.35	1.182	1	48
$(NH_2)_2CO$-NH_3 (2)										
Type A.....	32.5	28.9	18.1	20.5	45.5	.....	30.4	.985	66	5
B.....	43.1	23.5	15.1	33.7	45.3	.....	25.2	1.046	55	30
C.....	27.1	24.1	16.4	17.0	37.9	.....	25.3	.987	24	0
D.....	35.9	19.6	13.7	30.7	37.7	.....	21.0	1.038	24	..
5.....	43.1	30.6	....	26.3	45.3		25.2	.976	53	46
37 (5)...					37.2 (5)		20.6	1.05	25	30–35
Ammonia										
Anhydrous		99.9		....	82.2		82.2	0.618	211	..
Liquor (30%)		30.0		70.0	24.6		24.6	0.895	11	..

(1) Ammonium Nitrate-Ammonia Solutions.
(2) Urea-Ammonia Solutions.
(3) For An-A the Inorganic Nitrogen Content is the same as the Total Nitrogen Content, for Urea-Ammonia Liquors it is the same as Ammonia Nitrogen.
(4) Approximate.
(5) Includes Formaldehyde which forms Insoluble Organic Compounds after Ammoniation. Material Contains 9.1 per cent Urea Nitrogen; 7.5 per cent Insoluble Organic Nitrogen.

reversion was not reached for over six months at 25° to 30° C.

From a correlation of factory and experimental results, the following rates of reaction have been set up for average mixed fertilizer containing more than 6 per cent moisture and more than 2 to 3 per cent nitrogen introduced into superphosphate as ammonia. A stable product obtained in one week at 80° C., in one month at 60° C., in four months at 50° C., and in six to 12 months below 40° C.

As rates of reaction are almost entirely dependent on free moisture at temperatures below 60° C., these figures are estimates in the low temperature region.

Two Kinds of Water

There are two kinds of water in superphosphate—chemically combined water of hydration and free water. The ratio of free to combined water depends upon the temperature. Samples stored at 80° C. were always moist to the touch, even though analysis showed only 3 to 4 per cent water.

Sixty-degree samples were appreciably dryer but still damp, and at 40° or below the same material was dusty. This indicated hydrates ranging in stability from decomposition at 40° to 80° C.

Past experience has indicated that ammoniated material containing over 6 per cent moisture is in what might be termed a normal state of hydration and also has some free water. Such a product, if highly ammoniated, will show slow reversion at 25° to 40° C. during the first six months. On the other hand, mixtures containing less than 6 per cent water may remain unchanged for a year at low temperatures.

From what has been said, it is possible to set up certain plant operations to obtain minimum insoluble P_2O_5 with maximum ammonia absorption.

It is highly beneficial from the standpoint of insoluble P_2O_5 to cool ammoniated goods soon after introduction of the ammonia. Such products are far from equilibrium mixtures and could be compared to super-saturated solutions.

Low temperatures result in stability for appreciable lengths of time only if accompanied by dryness. Desirability of cooling products, therefore, must be judged mainly on the probable free moisture content after cooling, if stability of product is considered.

Another factor influencing the stability of cooled goods is the initial temperature of ammoniation. During the experiments it was noticed that superphosphate ammoniated to over 5 per cent N, and thereby reaching 90° to 100° C., was more stable at atmospheric temperatures than material ammoniated to only 3.5 to 4 per cent in which the temperature reached only 70° to 80° C.

To substantiate this, a batch was ammoniated to 5 per cent N in two steps and the temperature never allowed to rise above 70° C. This product lost 2 per cent available P_2O_5 in four months at 25° to 30° C. whereas a corresponding 5 per cent N product ammoniated at 90° to 100° C. lost only 9.2 per cent P_2O_5.

It seems advisable, therefore, to avoid cooling during ammoniation, and even soon after, if over 6 per cent moisture is present. Cooling after a few days' storage at elevated temperatures, piling ammoniated goods in small open piles, or anything to facilitate loss of free moisture or cooling, however, probably would delay the reversion reaction at least six to eight months.

Warm Piles

Centers of large warm storage piles containing enough ammonia to cause reversion show higher reversions than the surfaces of the same piles after a few weeks, but the surface material after a year would probably be identical to the center.

Hardesty, Ross and Adams (2) showed the citrate-insoluble P_2O_5 in ammoniated 4–12–4 mixtures containing superphosphate at different degrees of ammoniation, at different storage temperatures, at different moisture contents, and with and without dolomite.

Keenen and Morgan (5) determined the effect of moisture on water soluble P_2O_5 and citrate insoluble P_2O_5 in 4–8–4 containing dolomite and ammoniated with urea solution when stored at 54° C.

In this work the authors state that moisture content from 5 to 10 per cent has little influence on P_2O_5 reversion on urea hydrolysis. Mixtures containing less than 5 per cent moisture are practically inactive.

In previous work using anhydrous ammonia, Keenen (4) found reversion did not take place below 6 per cent moisture content. Since urea displaces the water of hydration in calcium sulfate (10) and ortho phosphates (11) the 5 per cent moisture probably had as much free moisture as the 6 per cent moisture mixture where urea was absent.

Fluorine Reaction

MacIntire and Hardin (7) found that, in the presence of moisture, fluorine reacts with tri-calcium phosphate to form fluorophosphate, similar to the native phosphorite of raw phosphate rock.

Hardesty and co-workers made a study of caked fertilizer in relation to initial moisture content and particle size. They found that the crushing pressure required to disintegrate the cake increases with increase of moisture content. ◆

Next month the authors will summarize the description of ammoniated superphosphate and point out optimum plant operations insofar as lack of reversion and bagcake are concerned. Moisture content, ammoniation temperature and ratio of free and combined moisture also will be discussed.

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Bureau of Plant Industry

Toxaphene

Has become a leading pesticide since developed four years ago

TOXAPHENE, since its first commercial production in 1947, has become one of the leading organic insecticides on the market. Because of its versatility and effectiveness in controlling a wide variety of insects, toxaphene has received wide recommendation for use in combatting cutworms, army worms, boll weevils and grasshoppers.

The insecticide is based on a toxicant derived from turpentine found in southern pine. It is made by chlorinating camphene to a chlorine content of from 67 to 69 per cent. This material, whose approximate empirical formula is C10h10C18, is a yellow waxy solid with a mild agreeable odor, insoluble in water but readily soluble in organic solvents.

The chemical, toxaphene, is manufactured by Hercules Powder company but that company does not make finished insecticides. The insecticide is available as a dust or as a spray in the form of emulsifiable concentrates, oil solutions or wettable powders.

The development of toxaphene to its position as a valuable foe of cotton insects, livestock pests, alfalfa insects, cutworms and army worms, grasshoppers, peanut insects and other insects started in 1929.

Terpene Products

At that time Hercules decided to explore the possible use of products derived from pine oil, turpentine and rosin in insecticides and disinfectants. After trying hundreds of compounds, the field was narrowed to chlorinated camphene.

Chlorineted Camphene

Chlorinated camphene was found to be very effective because it is chemically stable, it is highly toxic to many insects and it can be formulated easily into finished insecticides. Experimentation showed that the finished insecticides are nonphytotoxic to a wide variety of crops and it can be used with safety to humans and other warm-blooded animals, when certain precautions are taken.

Next, the company determined the proper degree of chlorination of the camphene for the most effectiveness against insects. When this had been completed, Hercules

turned the development into a production reality.

The material was sent to the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture for testing. Samples were sent also to universities and to state agricultural experiment stations. Scores of field evaluations were made.

In the four years of production of toxaphene, it has been recommended by the United States Department of Agriculture and nine state experiment stations.

In actual use, toxaphene has been effective in many fields. Surveys showed that in 1950 cotton insects reduced total crop yield in the country 16.5 per cent—equal to approximately 2,500,000 bales of cotton and 4,000,000 tons of cottonseed. Use of toxaphene eliminates part of this big loss, because it has been found to be one of the most effective insecticides science has made available to the cotton farmer. It is especially useful in this field, because it controls mixed insect populations. It controls such pests as cutworms, thrips, fleahopper, boll weevil, aphids, grasshoppers, leafworms, bollworm and other pests.

The general use of toxaphene calls for 10 to 15 pounds of 20 per cent toxaphene dust per application per acre. In spray form, it can be applied to give two or three pounds of actual toxaphene per acre.

Five or six treatments with the insecticide are recommended for complete seasonal control in fighting cotton insects. It can be applied by any of the usual ground dusters and should be applied early in the morning, in the late afternoon, or at night, when the air is calm.

Livestock Pests

Toxaphene insecticides have been recommended for control of insect pests on beef cattle, sheep, wool producing goats and swine. Extension services in Mississippi and Louisiana also have given their approval to the chemical. It is used to combat ticks, lice and horn flies on the animals.

One treatment of lice infected cattle often has been sufficient to control the pests. A spray of the proportions used against ticks is recommended. Similarly, the spray, applied at the rate of about two quarts per mature animal, can be used effectively against horn flies.

Control of ticks and lice on sheep and goats also has been reported as very successful when a toxaphene dip containing .05 to .2 per cent of the insecticide is used. The sheep tick causes the animals to rub, bite and scratch at the wool, thus spoiling the fleece. The pest also interferes with normal weight gain.

Swine may be protected against lice by use of a .5 per cent spray, the USDA has found. Frequently only one treatment of spray is necessary to control the lice.

Likewise in the production of alfalfa, toxaphene has been found valuable for control of many insects. These include Lygus, the alfalfa weevil, blister beetles, spittlebug nymphs, the clover seed chalcid and webworms.

An additional good feature of the insecticide is that it is one of the few insecticides that have been found sufficiently harmless to honeybees for use when alfalfa is in bloom. This is important because bees are responsible for approximately 90 per cent of alfalfa pollination.

Worm Control

It is in the control of cutworms and army worms that the insecticide has received special commendation. Toxaphene insecticides are recommended in an official bulletin of the USDA, and in addition, the states of New York, Mississippi, Louisiana, Georgia, Iowa, Texas, Wisconsin, California and Connecticut have recommended the chemical for use against the worms.

Since 1948, toxaphene has been recommended by the USDA for grasshopper control. It can be used on infestations of young grasshoppers found on roadsides, canal banks, field margins, or idle land next to cultivated fields.

Grasshoppers are extremely destructive pests. One of the insects can eat approximately 10 per cent of its weight at a meal, according to experts.

Seventeen adult grasshoppers in each square yard of a 40-acre alfalfa field could consume one ton of cured alfalfa a day. Spraying or dusting the infestations after the main hatch is completed greatly reduces the acreage to be treated. The insecticide also protects corn and other crops if field margins are treated before the insects move in.

The product may be used as a spray or dust or as a bait in the extermination of grasshoppers. The USDA recommends application of one to one and a half pounds per acre when used as a spray and from one and a half to two and a half pounds per acre if used as a dust.

Application Rate

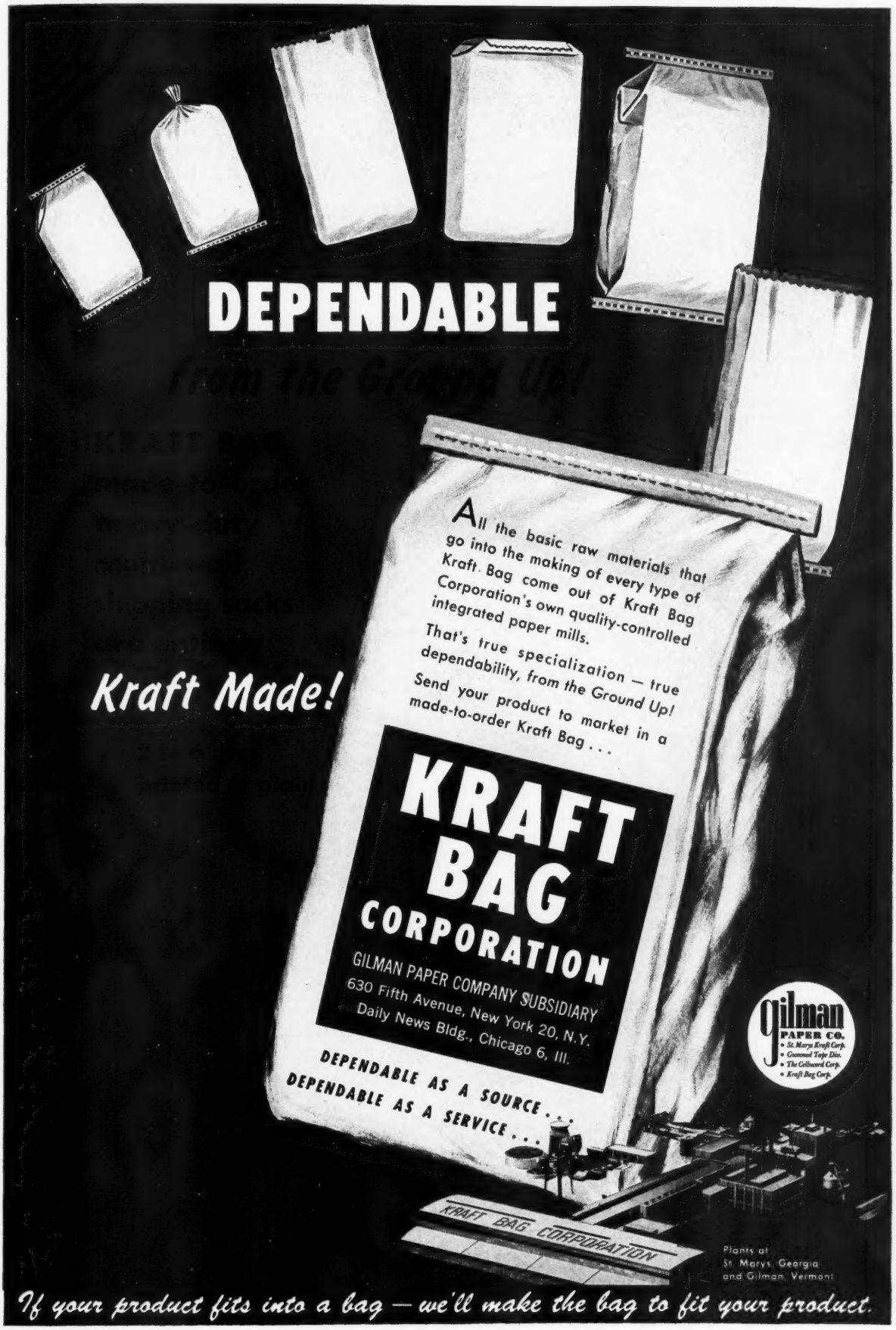
So that the rate of application of toxaphene is accurately controlled, the equipment used should be carefully adjusted. This includes ground sprayers, dusters or airplanes.

Higher yields from peanut crops have been realized through use of toxaphene to control peanut insects. The insecticide gives quick initial control and continues to kill insects over a long period of time. In addition to all these uses, toxaphene kills dozens of other insects on many plants.

In the important field of toxicity, toxaphene shows the highest acute toxicity of the chlorinated hydrocarbons, although it has the lowest level of chronic toxicity. In addition to being safe for use on livestock, toxaphene is not injurious to a wide variety of plant species and will not cause off-flavor in fruits or vegetables, including tomatoes, oranges, beans, peaches and potatoes, when properly applied.

Like most insecticides, toxaphene can be poisonous to man and livestock if precautions are not taken. Because the residue resulting from spraying or dusting crops may persist for days or weeks after application, forage treated with the chemical should not be fed to dairy animals or animals being finished for slaughter.

More than 80 manufacturers use toxaphene in making insecticides which have been recommended for combatting 74 destructive insects. Toxaphene still has drawbacks, but it has come along way since 1947. ◆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Figuring the Fertilizer Triangle

An exact method for computing key fertilizer mixing formulas

Lee Fryer and
L. C. Perkins*

IN THE Sweet Bye and Bye, in the Land of the Big Rock Candy Mountain, we will have big bins full of 11–48, treble, and 16–20. Our mixes will never heat or harden. The customers will always smile. Even the smell will be lovely.

Meantime, we must scrounge around and do the best we can with what we have—a little 11–48 here, and a little 16–20 there, and a few tons of treble every other year.

We often re-write our fertilizer formulas several times a season, depending on what materials we have at hand. We must crowd in the plentiful materials, and conserve the scarce ones.

Formulating by trial and error then becomes a bothersome procedure—especially when two kinds of ammo-phos are used in the fertilizer.

In view of these tribulations, we have found it practical at the Chas. H. Lilly Company to use an exact method of computing the key fertilizer formulas.

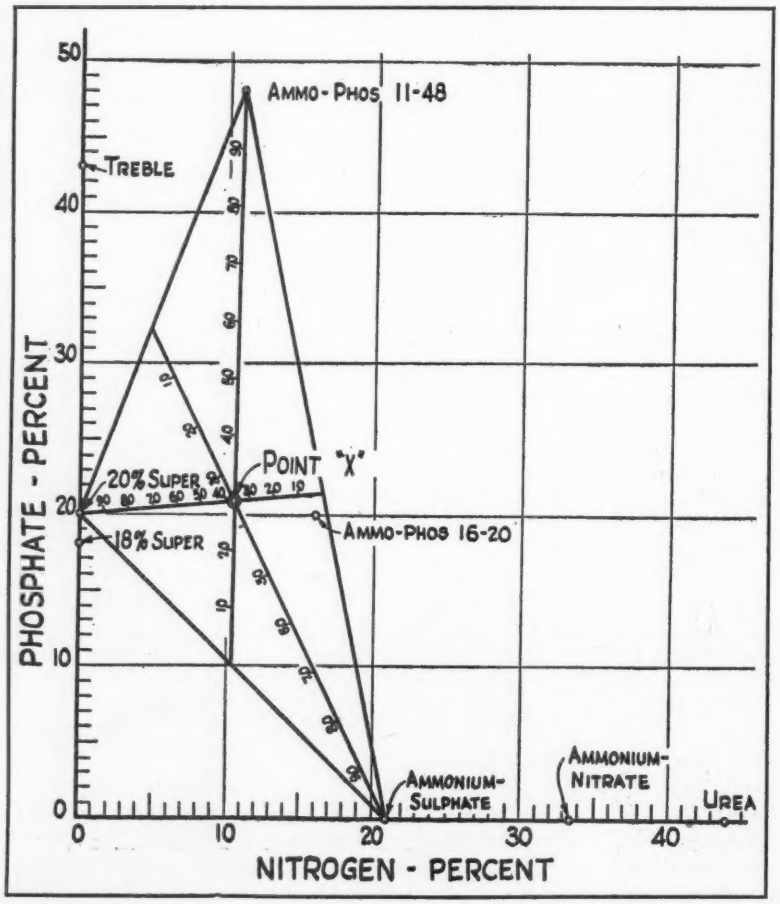
At the outset, certain things are known about a fertilizer to be formulated. The number of pounds per ton of potash bearing material is known, or at least can readily be found. Also, the number of pounds of filler material may be specified in advance. These two components, potash bearing material and filler, may be fixed quantities in a given formulation regardless of how the remaining pounds per ton are juggled to supply the correct amounts of nitrogen and phosphate.

The difficult part of the problem boils down to the question: In what quantities should various nitrogen and phosphate materials be added to give exactly a ton of fertilizer containing the desired pounds of nitrogen and P_2O_5? This part of the problem can be cracked by using a graphical diagram plus a rubber band gimmick.

Stand by, and we'll demonstrate. We will formulate an 8–16–8 fertilizer with 200 pounds of filler. Note that you can predetermine the amount of filler for conditioning purposes, or you can reserve space for borax or other minor element compounds.

Step 1. Write down the percentage factors of nitrogen, phosphate,

"Fertilizer triangle" used by the Charles H. Lilly Company for exact computation of key fertilizer formulas, eliminating trial and error



**Fryer is manager of fertilizer department, Chas. H. Lilly Company. Perkins is research engineer, Boeing Airplane Company.*

potash, filler, and incidental materials (these latter are the carriers of N, P, and K. Example: the other 79 per cent in 21 per cent sulphate of ammonia). See Table 1.

Step 2. Subtract (a) the K_2O, (b) the incidental materials carrying the K_2O, and (c) the filler.

Step 3. Divide the nitrogen and P_2O_5 factors by the remaining total. Don't ask why. This is necessary because Einstein says so.

We now have a nitrogen factor of 10.4 and a P_2O_5 factor of 20.8. These give a mathematically correct description of our 8–16–8 fertilizer from the standpoint of N and P. The K and filler ingredients are predetermined.

The point 10.4–20.8 is marked on our formulating chart. (See computations and chart).

Turning now to the chart, you will note that the vertical scale is the phosphate scale. On the line to the left are single super, treble, and any other straight phosphate materials. The base line is the nitrogen scale.

As you go to the right, the sulphate of ammonia, ammonium nitrate, and urea are located. The area in between is for nitrogen-phosphate compounds, such as ammo-phos 11–48 and ammo-phos 16–20. The point 10.4–20.8 is located at exactly the place that will give the fertilizer enough phosphate and nitrogen.

You can make the 8–16–8 fertilizer out of any three materials forming corners of a triangle that surrounds our point 10.4–20.8. For example, you can make it out of (a) sulphate of ammonia, 11–48, and 20 per cent superphosphate, or (b) ammo-phos 16–20, 20 per cent superphosphate, and ammo-phos 11–48.

You cannot make the 8–16–8 fertilizer with 200 pounds of filler out of sulphate of ammonia, ammo-phos 16–20, and 20 per cent superphosphate, since the point lies outside a triangle connecting these points.

If you lay a ruler on the treble point and the sulphate of ammonia point, you will find that the spot X is almost on this line. This shows that the fertilizer could be made out of only the two materials sulphate and treble in proportions that can be measured from the chart.

Table 1.
Percentage Analysis of 8-16-8 Fertilizer

	N.	P_2O_5	K_2O	Incidental Materials	Filler	Total
Step 1....	8	16	8	58	10	100 per cent
Step 2....	(subtract)		8	5.3	10	23.3 "
	8	16	0	52.7	0	76.7 "
Step 3....	10.4	20.8		68.8		100.0 "

Table 2.
Computation of Nitrogen and Phosphate Compounds

Material	Per cent Yonder End Is of Total Line	Round-Off	Multiply Times 1534 Pounds
Ammo-phos 11-48.....	27.5	28	430 pounds
Sulphate of Ammonia..	34.8	35	537 "
20 per cent Super.....	37.7	37	567 "
	100.0	100	1534 "

Table 3.
Formulation of Fertilizer

Material	Quantity	Pounds N.	P.	K.
Ammo-phos 11-48.....	430	47	207	...
Sulphate of ammonia.....	537	113	...	...
20 per cent Super.....	567	...	113	...
Muriate of potash.....	266	...	...	160
Filler.....	200	...	...	...
Total.....	**2000**	**160**	**320**	**160**

To complete the formulation of the 8–16–8 fertilizer, perform the following additional steps:

Step 4. Select the three materials desired to supply the nitrogen and phosphate in the fertilizer. Using each as a corner point, draw the triangle on the chart connecting each material, and enclosing the point 10.4–20.8.

Step 5. Draw a line from each corner through the point X to the opposite side of the triangle. (See the chart.) The yonder end of each of these lines gives the measure of the quantity of that material needed in the mix. In fact, the percentage that the yonder end of the line is of the total length of the line, is the per cent of this material needed, among the three materials in question.

Step 6. Compute these percentages. Then note in Table 1 that the nitrogen and phosphate compounds in the fertilizer will comprise 76.7 per cent of the total weight. This portion of a ton is 1,534 pounds.

With the percentages of each material now at hand, the quantities can be determined. (See Table 2.)

The 8–16–8 fertilizer is now formulated, so check for accuracy, as shown in Table 3.

Now comes the gimmick. The percentages of the three nitrogen and phosphate carriers can be measured directly from the chart with a rubber ruler! Simply stretch a strong, wide rubber band (about ¼-inch wide is suitable) along a ruler or yardstick. With the band stretched, mark off ten intervals.

Using this rubber ruler, you can read directly the percentages from the lines on the chart, giving the 28 per cent, 35 per cent, and 37 per cent figures.

Final adjustment with a few pounds either way of sulphate of ammonia or super will balance off the formula. ◆

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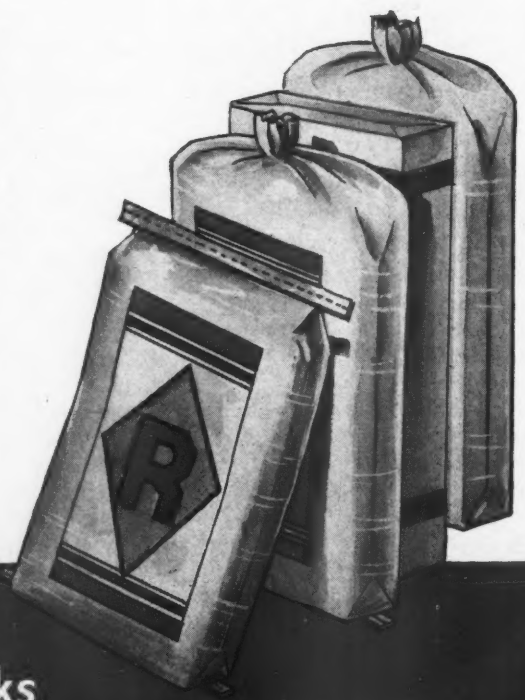

RAYMOND *Multi-Wall*
Paper Shipping Sacks

FERTILIZER MATERIALS MARKET

New York

October 31, 1951

Sulphate of Ammonia

This material continues to be sold up as far as the producers are concerned but some are having difficulty in getting buyers to take delivery. No price changes were noted.

Nitrate of Soda

Imported nitrate of soda has been advanced $3.50 per ton and the domestic producers have advanced their price $2.50 per ton.

Ammonium Nitrate

Shipments are going forward on contract with producers selling all they can produce. Here again a possible shortage is looked for in the Spring.

Nitrogenous Tankage

Most of the leading producers have withdrawn from the market because of the shortage of raw materials that go into making this material. Unless the situation improves, there will be a decided shortage of this material this season.

Castor Pomace

This material is in very heavy demand due to the curtailed production and while last sales were made some time ago at $37.25 per ton, f.o.b. production points, there has been none offered for some time.

Organics

Organic materials have been in a strong position for the past month but a slightly easier tendency has been noted the past few days because most of the feed buyers have temporarily withdrawn from the market. However, soybean meal is still selling at the ceiling price of $74.00 per ton, f.o.b. Decatur, Ill., and in some instances is hard to obtain even at this figure. Future positions are offered at slightly lower prices. Linseed meal is strong but cottonseed meal has shown a slightly easier tendency. Tankage and blood last sold at $8.50 per unit of ammonia ($10.33 per unit N), f.o.b. Eastern production points, but these prices could probably be bettered.

Fish Meal

Menhaden fish meal, where available, is selling at the ceiling price of $135.60 per ton f.o.b. fish factories. However, fishing operations at most plants in the North have come to an end and a tighter situation is looked for. Imported fish meal continues to arrive at various ports and commands a slightly lower price.

Bone Meal

This material continues in a very strong position. Offerings of fertilizer grade steamed and raw bone meal are hard to locate at a reasonable price. Demand for feeding bone meal continues excellent and a considerable quantity of foreign material is arriving.

Hoof Meal

While last sales were made on the basis of $7.25 per unit of ammonia ($8.82 per unit N), f.o.b. Chicago, the market was said to be slightly lower and buying interest dull at the moment.

Superphosphate

While predictions are being made of about a 20 per cent shortage of this material before the season is over, here again buyers are slow to take delivery against contracts and in some cases do not seem to be worried about the situation. The sulfur supply situation is the key to whether any extra super will be made.

Potash

Producers are shipping against existing contracts and in some cases buyers are a little slow to order the material out. However, it is expected this condition will change shortly. Demand for imported potash was negligible at present.

Philadelphia

October 31, 1951

As a whole, there does not appear to be any serious shortage of raw materials, and resale lots do not find ready outlet at a premium. Blood and tankage seem to be in ample supply to meet present demand and the price position is slightly easier. Both the domestic and the imported grades of nitrate of soda have been advanced in price. Smaller mixers are still slow in ordering superphosphate, and potash shipments are said to be moving almost on schedule.

Sulphate of Ammonia.—While shipments are now being made from production, the supply seems to be keeping up fairly well with demand. The position, however, can properly be termed tight. Resale offerings are limited and no interest is shown in premium prices.

Nitrate of Soda.—Price has been advanced on both Chilean and the domestic grade. Chilean went up $3.50 per ton, making present bulk price $53.50 and bagged $57.00. The domestic advance is $2.50 per ton, which means bulk carloads at $47.50 and bagged $51.00 at the producing plant.

Blood, Tankage, Bone.—Blood is easier than a week ago and quoted currently at $8.50 per unit of ammonia ($10.33 per unit N), both here and in the West. Tankage remains fairly steady at $8.50 ($10.33 per unit N) here and $8.75 ($10.63 per unit N) in the West. Bone meal is in strong demand and supply limited. Recent quotations range from $67.50 to $75.00 per ton.

Castor Pomace.—This continues in active demand, but no offerings are in the market.

Fish Scrap.—Market is quiet and supply reported scarce. Limited offerings of menhaden meal have been quoted at $135.00 per ton, which is slightly under the ceiling. Production thus far this year seems to be somewhat ahead of 1950.

Superphosphate.—Spot material is scarce and market position tight. Mixers continue to delay ordering

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and seem not at all bothered by anticipated shortage later on.

Potash.—Domestic output for the season is practically all sold ahead and shipments continue practically on schedule with not too much delay due to car shortages.

Charleston

October 31, 1951

Fertilizer mixers are still beset with the problem of getting sufficient superphosphate to make their complete mixtures and this ingredient will be the governing factor in the quantity of mixed goods produced. There is also a tendency for nitrogen to tighten in supply. Potash in the Coastal areas is relatively easy in supply but in the Midwest demand continues in excess of supply.

Organics.—The market on organics for fertilizer use is rather inactive although recently some limited supplies of domestic nitrogenous were offered due to request for delayed shipments against contracts. Prices of domestic nitrogenous are nominally $4.25 to $4.90 per unit of ammonia ($5.16 to $5.95 per unit N), bulk, f.o.b. shipping point. Offerings of imported nitrogenous are rare at prices around $6.00 per unit of ammonia ($7.29 per unit N) in bags, c.i.f. American port.

Castor Pomace.—Domestic producers are in a sold up position and at present, due to the New York dock workers' strike, imported castor beans are tied up necessitating shutdowns at domestic producers' plants. Price is nominally $37.25 per ton in burlap bags, with an allowance of $2.00 per ton if shipment is made in paper bags. These prices apply on material guaranteed minimum 6.75 per cent ammonia.

Dried Blood.—The blood market has strengthened and the Chicago market is now around $8.25 to $8.50 per unit of ammonia ($10.02 to $10.33 per unit N), in bulk for unground blood. The New York market is around $8.75 ($10.63 per unit N) asked.

Potash.—Movement from domestic sources is steady, hampered slightly by boxcar shortages. Some smaller mixers have requested delays of shipment and in some cases cancellation because of lack of sufficient superphosphate. Imported potash continues to arrive in good volume at prices around 65 cents per unit, c.i.f., in bulk, for 48/52 per cent K_2O material.

Ground Cotton Bur Ash.—Supplies of this source of potash, primarily in the form of carbonate of potash, continue available for prompt and future shipment. Some of this material is guaranteed minimum 40 per cent K_2O for freight purposes while other productions test 30 to 40 per cent K_2O.

Phosphate Rock.—Demand continues heavy in spite of the shortage of sulphuric acid. Prices continue firm with a tightness of supplies apparent in the higher grades.

Superphosphate.—No surplus supplies of normal or triple superphosphate have appeared in the market and most producers are forced to cut dry mixer customers up to 20 per cent due to shortage of sulphuric acid. Prices are maintained at ceiling levels.

Sulphate of Ammonia.—Accumulation of stocks at the coke ovens is prevented by sufficiently active demand which moves the material directly from production. Prices continue from $40 to $45.00, depending on location of the shipping point.

Ammonium Nitrate.—Overall demand continues in excess of supplies with prices unchanged. Imported material at $69.50 and domestic material $61.00 to $63.00, f.o.b. shipping point, in bags.

Nitrate of Soda.—The price of imported nitrate of soda in bags has been increased recently by $3.50 per ton, making the current price $57.00, f.o.b. cars at the ports. Domestic nitrate of soda has been increased by $2.50, making the current price $51.00 f.o.b. Hopewell, Va. Demand is at seasonal levels.

Fields Elected Safety Head

J. S. Fields, safety director of Phillips Chemical Company, was elected president of the fertilizer sub-division, Chemical Division of the National Safety Council in a meeting of the group in Chicago October 12.

Other officers elected at the meeting were J. E. Smith, safety director of Spencer Chemical Company, vice chairman; and Vernon S. Gornto, manager of the insurance division, Smith-Douglass Company, secretary-treasurer.

Progress in fertilizer plant safety was described to the more than 200 persons attending the organizational meeting by W. W. Watmough, Jr., vice president of the mixed fertilizer division of Davison Chemical Corporation.

Watmough told of poor working conditions in which unskilled labor worked under hazardous circumstances only a few years ago. Approximately 80 per cent of plant workers were laid off part of the year because of the seasonal nature of the operations, he stated.

"The picture is much brighter today," he declared, citing the many improvements that have been made in plant working conditions.

The speaker said more progress could be made in plant safety if a sound safety program and a complete line of authority were set up, and if all employees would cooperate in the program.

Watmough urged the representatives to work for the establishment of better safety programs in all plants in the fertilizer industry.

The safety talk was followed up by a panel discussion on the topic "Achieving Safety in Fertilizer Plants," at which J. W. Sisson, safety director of the Tennessee Valley Authority, was chairman. Speaking on the panel were David P. Delevan, chemical superintendent, Pasadena Fertilizer Plant of Mathieson Chemical Corporation; H. R. Krueger, director of Technical Service, Phillips Chemical Company; U. C. Ellis, general superintendent, plant food division, Swift and Company; C. E. Killebrew, sales manager, The Frank G. Hough Company, and M. F. Wharton, secretary-treasurer, Arizona Fertilizer Inc.

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Fertilizer Control Officials Meet

Members of the Association of American Fertilizer Control Officials heard talks by the presidents of the National Fertilizer Association and the American Plant Food Council at their meeting in Washington, D. C., October 5.

The control officials also heard addresses by leaders in the farm chemicals field and heard reports of investigations on various phases of fertilizer production. The meetings were held in the Shoreham Hotel.

Paul T. Truitt, president of the American Plant Food Council, and Russell Coleman, president of the National Fertilizer Association, both reviewed the fertilizer outlook, emphasizing shortages, increased production and the work that lies ahead for the controls officials.

Dr. Rodney C. Berry, who was succeeded as president of the Controls Officials by Dr. J. F. Fudge, also addressed the group. He is now director of the division of chemistry, Virginia Department of Agriculture, Richmond. Dr. Fudge is state chemist of the agricultural experiment station, college station, Texas.

Also speaking at the fifth annual convention were H. B. Siems, chairman of the NFA research committee; F. E. Bear, chairman of the soils department, Rutgers University; and F. H. Levaitt, fertilizer department, Shell Chemical Corporation.

Dr. Fudge conducted a discussion period on how the Control Officials, the fertilizer industry and agricultural workers can coordinate their activities to have a sounder and more progressive agricultural program.

In addressing the Control Officials, Truitt declared "the fertilizer industry not only does not object to—but urges—a rigid regulatory and control program."

"Further increases in plant food consumption actually will mean that laboratories will have to make additional analyses and employ more trained personnel with which to inspect the production of the industry," he stated.

The fertilizer industry is interested in encouraging and in supporting the state control organizations which, Truitt said, function to protect the fertilizer industry and the farmer alike against any who seek to practice unfair dealing.

Coleman, in his address to the group, emphasized the shortage of sulfur as one of the most important problems facing the industry for the coming year. ◆

Photo Courtesy A.P.F.C.

Newly elected officers of the Association of American Fertilizer Control Officials are, left to right: Dr. J. A. Fudge, president; P. A. Yeats, vice president; Dr. Rodney C. Berry, ex-officio member of the executive committee; H. A. Davis, R. W. Ludwick and G. W. Michael, of the executive committee. Officials were guests of American Plant Food Council

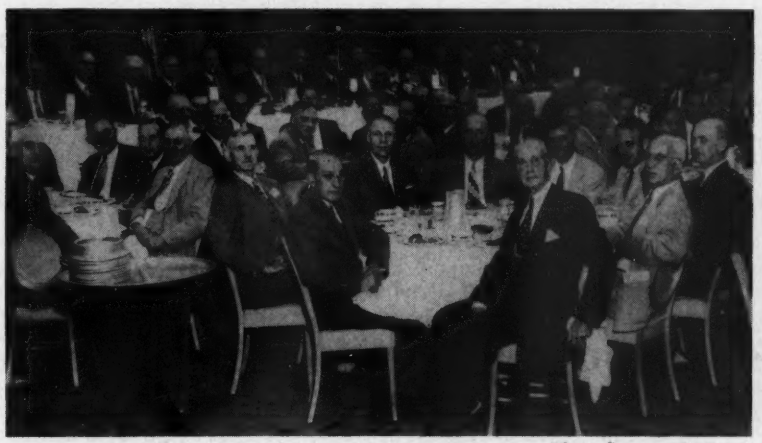
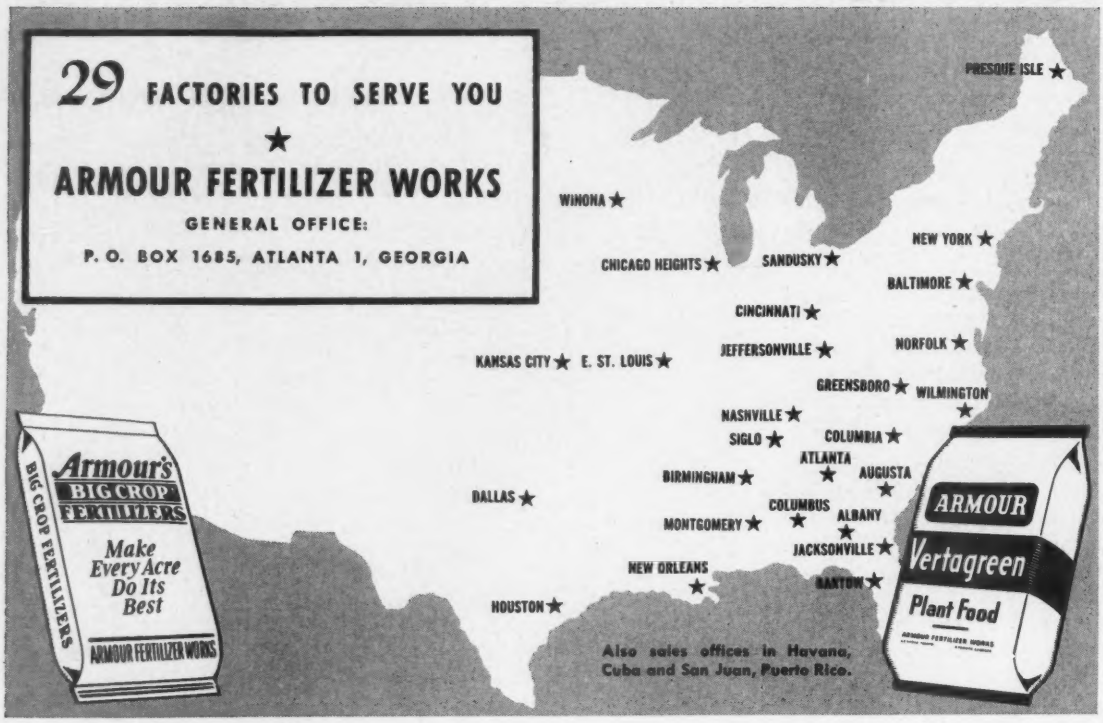


Photo Courtesy N.F.A.

Members of the Association of American Fertilizer Control Officials were guests of the National Fertilizer Association at dinner in the Shoreham Hotel, Washington, D. C., at the fifth annual convention, Oct. 5



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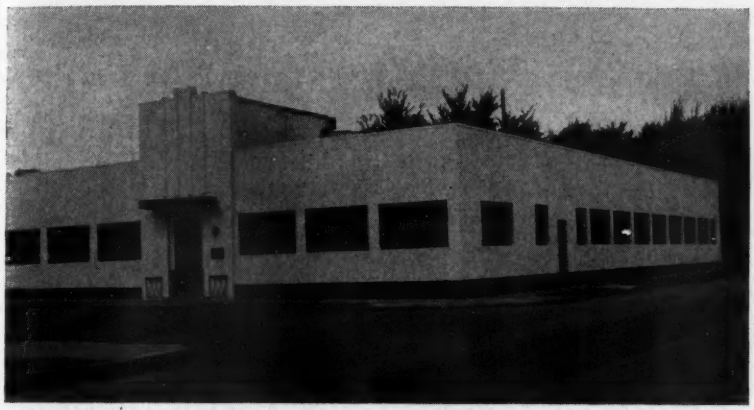

New general offices of the Thurston Chemical Company in Joplin, Mo., which will serve six Midwestern states, handling Bem Brand fertilizer

Thurston Chemical Company of Joplin, Mo., have announced the opening of their new general offices at 102 Wall St. approximately 50 persons now are employed there.

The modern, one floor structure has 8,640 square feet of floor space, a fire-proof walk-in vault, suspended acoustical ceiling, and a large conference room. Automatic hot water heating and air conditioning systems have been installed.

Approximately 20 cars are accommodated at a nearby company parking lot.

Sulfur Limitation Orders Are Delayed

Orders limiting the uses of sulfur, sulfuric acid and carbon bisulfide were delayed November 1 for not more than 30 days after the Defense Production Authority and the National Production Authority met with industry advisory groups.

However, the two agencies said they would go ahead with plans to issue a sulfur inventory limitation order.

They delayed the other limitation orders to give the industrial committees additional time to study the proposed sulfur program.

The proposed limitation orders drawn up by NPA are the following:

1. Use of sulfur for the production of sulfuric acid or carbon bisulfide would be limited to 90 per cent of each plant's use of sulfur during 1950. Adjustments would be made for plants supplying sulfuric acid for certain essential programs, including agricultural insecticides and pesticides.

2. Each plant using carbon bisulfide for the production of cellulose film or rayon would be limited to 90 per cent of its 1950 rate.

3. Each plant using sulfuric acid for the following purposes would be limited to 90 per cent of its 1950 uses: aluminum sulfate for uses other than public water treatment, synthetic detergents, lead, zinc and titanium pigments, dyes cellulose film, rayon, sulfonated oils used in textile finishing, tall oil, textile finishing and phosphatic fertilizers.

Principal advisory committee suggestions on the proposed limitations were the following:

1. That limitations be based on a company basis rather than on an individual plant basis.

2. That limitations be based on quarterly or longer basis instead of on a monthly basis.

3. That an inventory of more than 25 days' requirements be permitted to allow ship cargo deliveries.

4. That captive sulfur (that produced by the company itself) be at the complete disposal of the company instead of only the 50 per cent proposed.

NPA representatives promised full consideration of all committee comments. In the meantime, NPA officials asked sulfur and sulfuric acid users to comply with the spirit of the proposed orders during the temporary delay to avoid serious disruption of sulfur distribution and its uses in essential defense and defense-supporting programs.

Constable Elected Head Of Pest Control Officials

Dr. E. W. Constable, state chemist of North Carolina, is the newly elected president of the Association of Economic Poisons Control Officials.

Dr. Constable, who was elevated from the vice presidency of the organization, recently completed a term as president of the Association of Food and Drug Control Officials of the United States.

He is head of the Analytical Division of the North Carolina Department of Agriculture, which is responsible for the enforcement of laws and regulations relating to insecticides, feeds, fertilizers, foods, drugs, and cosmetics.

New Nitric Acid Process

An improved Fauser process for direct manufacture of nitric acid by oxidation of ammonia with pure oxygen has been announced by Bamag-Meguin.

Either 60 per cent acid is obtained, for further conversion into sodium nitrate, ammonium nitrate, calcium nitre and ammonium sulphate, or 98 per cent concentration

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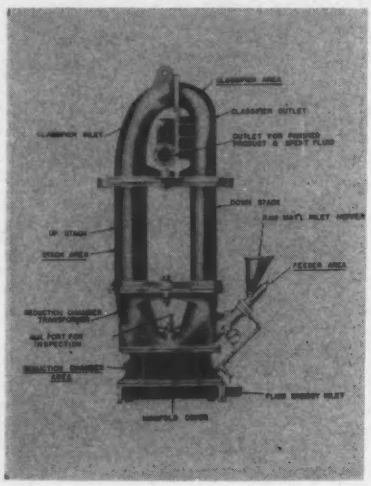
10-1 Wheeler Mill



Wheeler Reduction Mill

Wheeler Fine Particle Reduction Mills, formerly leased only on a rental basis, are now available for purchase. Two sizes are available and both have been used successfully to process pesticides.

In operation, raw material of four mesh size or smaller is introduced continuously into the inlet hopper. An injector feeds the material from the hopper into a reduction chamber. At the same time pressurized fluid, air, steam or any gas enters the manifold and is discharged through nozzles into the chamber at sonic or supersonic velocities. The jet action breaks up individual particles by abrasion and impact against each other.

Centrifugal force shifts the larger particles toward the outer periphery and the small particles work toward the inside as they are reduced to the desired size. These escape with spent fluid through a classifier outlet into a centrifugal type collector.

The mills are available in two sizes, one handling 200 to 1,800 pounds per hour and the other 400 to 6,500 pounds. The larger model produces two and a half times more than the small mill using air and from three and three-fourths to four times more with steam.

Both sizes have no moving parts and reduce materials to submicron sizes. Uniformity, size, and shape of particles can be controlled and the manufacturer says that the fluid energy system uses less power than corresponding mechanical methods.

The cost of grinding for most materials in low and submicron sizes ranges from two to ten dollars a ton, depending on the grindability of the product and the fineness desired. Other operations such as coating, blending, and the breaking of agglomerates can be combined with the mills. Velocity, humidity, and pressure may be controlled to suit the process.

For more details fill in the **Reader's Service Card.** Ask for **10-1.**

Formula Prices Ordered For Ag Lime Products

Producers and sellers of agricultural liming materials in the continental United States must establish their ceiling prices by formula under a regulation recently issued by the Office of Price Stabilization.

The regulation applies to materials sold for spraying, dusting, and soil liming purposes, and includes ground or pulverized limestone, limestone screenings and meal, burned lime, hydrated lime, air-slaked lime, burned or ground mollusk shells, calcareous and dolomitic fertilizer fillers, marl, slag, and by-product liming materials such as sugar house lime and acetylene lime waste.

OPS claims that the regulation will relieve hardship in certain portions of the industry and help assure availability of supplies for the agricultural needs of the country. It is expected to result in a slight overall average increase in price.

Link Belt Appointment

Recently elected executive vice president of Link-Belt Company is Robert C. Becherer. Becherer, former vice president and general manager of Link-Belt's Indianapolis, Ind., plant, will be located in New York. Richard E. Whinrey, former assistant general manager of the plant, will succeed Becherer as general manager.

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CONTROL PANEL

These fast fertilizer processing systems have reduced production costs in some plants as much as 65% . . . An estimated cost savings included with a Sackett survey of your production operations may even exceed this figure.

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1. Eliminates waste of manpower.

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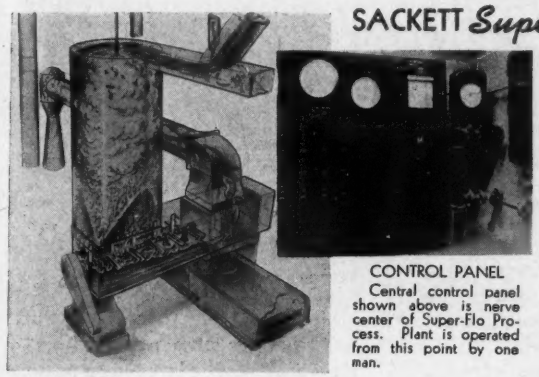
4. Its compact design permits installation in existing buildings with minimum alterations.

5. The installation of this system does not, in any way, disturb existing mixing facilities.

Built in four sizes, 25 tons to 100 tons per hour.



CONTROL PANEL
Central control panel shown above is nerve center of Super-Flo Process. Plant is operated from this point by one man.

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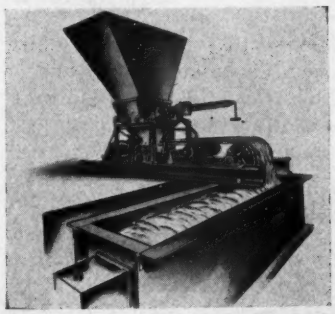
This new Sackett-conceived and developed process produces a superphosphate of premium quality in either powdered or granular form. Its complete mechanization and centralized panel control brings to the industry entirely new conceptions of high production speeds, low manufacturing costs and quality product control.

These Sackett patented processes are built in three sizes, 25 tons to 75 tons per hour.

Exclusive suspended acidulation produces highly converted superphosphate of excellent quality.



SACKETT CONTINUOUS AMMONIATING SYSTEM

The patented Sackett Continuous Ammoniation System is now being offered in four sizes with capacities ranging from 25 tons per hour to 100 tons per hour. This highly efficient method of ammoniating superphosphates and mixed goods with solutions offers many important advantages and is easily installed in connection with existing basing equipment. Higher ammoniation rates are made possible by its accurate proportioning of solids and solutions and lower reactive temperatures due to its exclusive aerating action which takes place during ammoniation. This system is also built in pressurized design for anhydrous ammonia or solutions having high vapor pressures.

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Nitrogen Materials Group Discusses Price Ceilings

Advisability of adopting dollars and cents ceilings on their products was discussed at the first meeting of the Nitrogen Materials Advisory Committee with OPS officials. Industry leaders reported that, for the most part, their products were being sold under ceilings fixed by the General Ceiling Price Regulation.

Members indicated that the industry had not elected generally to price under CPR 22 because of the competitive condition of the market and manufacturers of many products would have to price all that were subject to the CPR regulation if they elected to do so for nitrogen materials. They pointed out that under this regulation they would be entitled for moderate increases for the most part.

They indicated that, so long as costs remain at their present level, ceilings at the average level of either GCPR or CPR 22 would be acceptable. Committeemen expressed the thought that they might lose possible future adjustments for increased costs under CPR 22 if they were placed under dollars and cents ceilings.

They questioned whether taking nitrogen materials from under CPR 22 might not adversely affect the ceilings to which multiple product manufacturers would be entitled on other products where averaging devices are used in figuring ceilings and costs.

Members agreed to consider the matter and report back by mail after pointing out that ceilings should reflect customary price differences by geographical areas.

Committeemen also discussed the products that would be placed in the possible tailored regulation. Suggestions were made that ammonium-nitrate-lime compounds, ammonium nitrate, ammonium sulfate (synthetic), ammoniacal liquors, anhydrous ammonia, nitrate of soda, nitrogen solutions, urea, and urea compounds be included.

Potash Deliveries Increased

An increase of 4 per cent in the delivery of potash salts during the third quarter of 1951 compared with the same period in 1950 is reported by the American Potash Institute. Producers delivered 582,628 tons of potash salts containing an equivalent of 335,534 tons potash.

Agricultural deliveries in the United States, Canada, Cuba, Puerto Rico, and Hawaii amounted to 543,118 tons of salts, equivalent to 311,113 tons potash, comprised of 480,735 tons of muriate of potash, 2,189 tons of manure salts, and 60,194 tons sulphate of potash and sulphate of potash-magnesia.

The chemical industry took 33,652 tons of muriate of potash and sulphate of potash, containing an equivalent of 20,845 tons potash. Exports outside North America amounted to 5,858 tons of salts containing 3,576 tons potash.

New Davison Officers

M. J. Geiger

R. L. Hockley

Stockholders of the Davison Chemical Corp. recently elected M. G. Geiger, former executive vice president, to fill the position of vice chairman of the board. R. L. Hockley, previously vice president for marketing, succeeds Geiger.

10-2 Insect Control

Two new bulletins on control of insects on livestock have been issued by the agricultural chemicals department of Pennsylvania Salt Manufacturing Company.

One tells how to control flies and other livestock pests with Lindane and the other describes the technique for controlling insect pests on livestock with BHC, DDT, or Lindane. Fill in **Reader's Service Card** for more details. Ask for 10-2.

William Gauntt Joins Commercial Solvents

William A. Gauntt, a graduate of Rutgers University College of Agriculture, has joined the agricultural division of Commercial Solvents Corporation.

Gauntt will make his headquarters in Binghamton, N. Y., and will handle the sale of the company's feed, fertilizer, and insecticide products in the northeastern states.

International Super Meetings

Over 150 delegates attended Paris meetings of the International Superphosphate Manufacturer's Association sponsored by French members of the group. Papers on superphosphate manufacture, phosphoric acid manufacture, and calcined phosphates were among those presented at the series of technical meetings.

Inspections were made of chemical installations at Rouen, and Thann, France.

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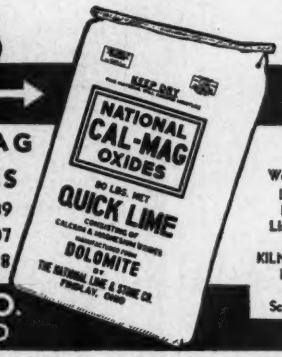

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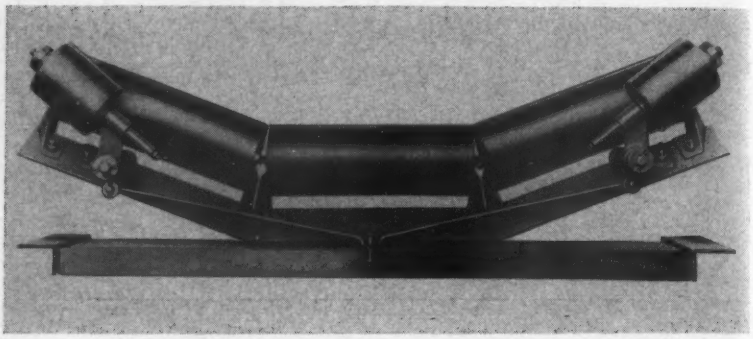

New Belt with 'Training Rollers'

A new belt training carrier, which returns the belt to the center of the carrier if it is deflected, is being produced by Stephens-Adamson Manufacturing Company.

The "training rollers" respond instantaneously to any shift of the belt off dead center and tilt the carrier into an angular position with the direction of belt travel. This returns the belt to the center. Edge wear of the belt is negligible, the company reports.

The unusually sensitive guiding action of the training rollers for return belts is due to the inclined axis about which the roller swings. If the belt runs to one side, the greater weight and drag on that side of the pivot tilt that end of the roller forward and down.

Rotation of the roller is then at an angle, which crowds the belt back to center. As the belt centers, the roller pivots back to neutral. For further information fill in the **Reader's Service Card.** Ask for **10-3.**

Appointed to Board of Directors

J. Peter Grace

J. Theodore Wolfe

J. Peter Grace, Jr., president of W. R. Grace & Co., has been selected a director of Davison Chemical Corp. to fill one of three newly created posts. Also named a director was J. Theodore Wolfe, Consolidated Gas, Electric & Power Co., Baltimore, Md., to fill the vacancy created by the death of E. J. Quintal.

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ELEVATORS, AND ALL OTHER EQUIPMENT FOR COMPLETE PLANTS

ATLANTA UTILITY WORKS EAST POINT, GA.

Brown Named Vice-President

Ernie E. Brown has been elected vice president of Arkell and Smith's.

Ernie E. Brown

Brown, who has been associated with the company for many years, will have headquarters at the company's New York City office.

Tag Sales May Set Record

Sales of tax tags and reports of shipments have indicated that the fertilizer industry may have set a new sales record in the past fiscal year.

Although a slight drop in sales for the month of September is reported, tax sales figures of 14 states indicate that 10 per cent more fertilizer was sold during the period of July 1, 1950, through June 30, 1951, than during the previous 12 months.

The states reported tonnage of 11.3 million tons for the past year as compared to 10.1 million tons for the preceding year. Because tax tag sales in these states represent about 55 per cent of the total national consumption, the NFA estimates approximately 20 million tons of fertilizer were sold during the recent year.

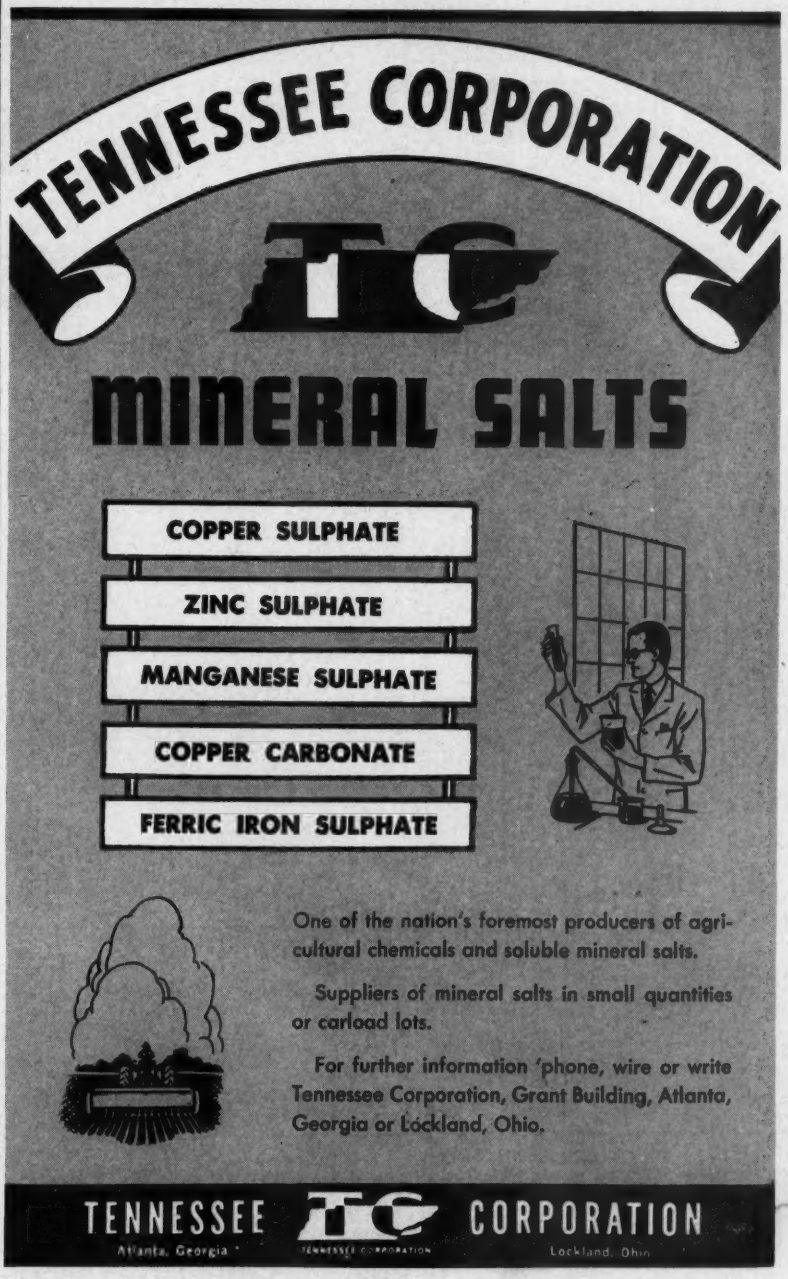
Tonnage in North Carolina increased from 1,682,365 in 49–50 to 1,838,500 in 50–51, while tonnage in Georgia went up from 1,173,518 to 1,297,764. An increase from 8,272,704 to 9,129,915 for the total south was reported.

Sales of tax tags and reports of shipments for September were the equivalent of 414,802 tons of fertilizer, 2,500 tons below an estimated 417,331 tons in September, 1950, but tag sales are running 5.7 per cent higher for the first eight months of the year over the 7.5 million tons sold during the same period last year.

India Fights Locusts With U. S. Equipment

India is going airbourne in its attempt to fight the locust menace. Three American Piper Supercub planes are operating in that country, equipped with wing booms from which Aldrin is sprayed.

Wanted: Assistant superintendent to take charge of the mixing and liquid formulation of insecticides. Must be technically trained and experienced in manufacture of insecticides. Give full details in first letter. Box 355, FARM CHEMICALS, 317 N. Broad St., Philadelphia 7, Pa.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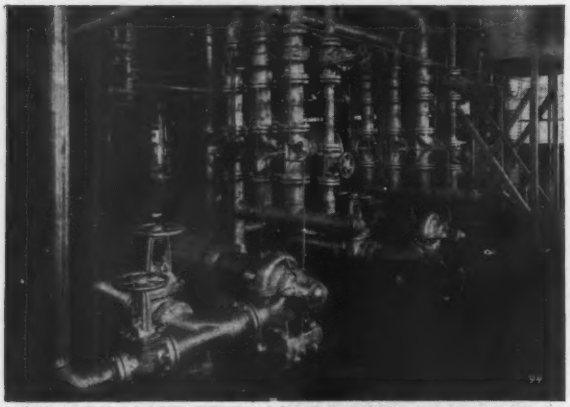
SINCE 1919 this modern plant near Sumter, South Carolina, has produced many tons of top quality fertilizer... adding hundreds of thousands of dollars to farm profits in the area.

LIKE SO MANY leading mixers, the Sumter Fertilizer Company, under the management of J. L. Nichols, depends on Spensol for nitrogen and Spencer Chemical Company for service.

Spensol Supplies the Nitrogen

...to Sumter Fertilizer Company, Inc.



SPENSOL (SPENCER NITROGEN SOLUTIONS) is made at two strategically located Spencer plants: Charlestown, Indiana, and Pittsburg, Kansas. An ever-increasing number of manufacturers have found that Spensol enables them to produce well-conditioned fertilizers at surprisingly low cost.

HIGHLY SKILLED TECHNICAL MEN on the Spencer staff may be in a position to help you with your production problems—whether you're a Spensol customer or not. Write Spencer's Technical Services Section at any time; there's no charge or obligation.

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Works: Pittsburg, Kans. Henderson, Ky. Chicago, Ill.

America's Growing Name in Chemicals

How You Can Get

Free Information

On each of the two postage-paid postcards below you can request further information on four items described on this and the Industrial News section of this issue. Fill out one quarter section for each item in which you are interested.

10-5 Conical Mill

Experimentation has shown that less energy is required to reduce a small particle to a given minimum size than is required to reduce a large particle to this same minimum size. The Hardinge Conical Mill is designed with this principle in mind, according to literature available from the company.

10-6 Materials Handling

Efficient materials handling can reduce operating costs and save money in any plant. Lightweight, portable power-driven belt conveyors, made by the Lake Shore Engineering Company, can effect such savings, the company states. Conveyors for bulk and packaged materials are described in a Lake Shore catalog.

10-7 Exact Weight Scales

With Exact Weight Sacking Scales, one man can fill and weigh a 100-pound sack in eight to ten seconds, the Exact Weight Scale Company declares. Literature describing the company's line of sacking scales and accessories has been printed. Operation of the scale is explained in detail in the bulletin. The company states that the scales are especially well adapted for the chemical industry. The indicator tower is adjustable to any position and the indicator dial can be read from any angle, according to the bulletin.

10-8 Reciprocating Pumps

Their line of reciprocating pumps is described in a catalog put out by the Warren Steam Pump Company, Inc. The line includes vertical and horizontal duplex piston, horizontal and vertical single piston, single and duplex outside packed plunger, and other types of pumps.

10-9 Fluid Pressure System

Application of the Baldwin SR-4 fluid

Here is a list of the NEW PRODUCTS and BULLETINS described on this and the Industrial News pages of this issue giving their monthly code number.

10-1 Wheeler Mill
10-2 Insect Control
10-3 Belt Training Carrier
10-4 Plastic Goggle
10-5 Conical Mill
10-6 Materials Handling
10-7 Exact Weight Scales
10-8 Reciprocating Pumps
10-9 Fluid Pressure System
10-10 Uniform Sprayers
10-11 DDT Emulsifier
10-12 Truck Equipment
10-13 Howe Trucks
10-14 Marlate Data
10-15 Payloader Shovels
10-16 Pesticide Processing
10-17 Fertilizer Explanation
10-18 Sulfur Shortage
10-19 Patterson Mill

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Company.....
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PHILADELPHIA 7, PA.

51 ☐ Write in the number of the product about which you want more information

Name.....
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51 ☐ Write in the number of the product about which you want more information

pressure measuring system in oil and chemical processing for automatic control, remote indicating and recording is featured in a new bulletin issued by Baldwin - Lima - Hamilton Corporation. Principles of the SR-4 bonded resistance wire strain gage and pressure cells are described.

10-10 Uniform Sprayers

Uniform distribution of spray throughout pattern area for even, proper coverage is one of the advantages claimed for the flat spray TeeJet Nozzles in a new bulletin. Other spray nozzles and their uses are described in the bulletin of the Spraying Systems Company.

10-11 DDT Emulsifier

Are your DDT concentrates giving you trouble? Do they break in soft or excessively hard water? Do they break down in storage, fail to meet all military specifications or cost too much because of formulation with an expensive emulsifier? Rohm and Haas Company claims to have the answer to these problems. Literature on its new emulsifier, Triton X-177, is available. It discusses the physical characteristics of toxaphene emulsions, the procedure for evaluation of stability of emulsions and the formulation of toxaphene concentrates. The physical characteristics of the tritons used for emulsifiers also are given.

10-12 Truck Equipment

A unique system of visual cross reference charts is used in a catalog offered by the Industrial Truck Division of Clark Equipment Company. The system makes all essential model and attachment information available at a glance. The catalog also features an attachments-and-devices cross-reference page which is designed to save time.

10-13 Howe Trucks

Specifications and illustrations for the complete line of Howe two- and four-wheel hand trucks, baggage wagons, platform skids and dollies are shown in a twelve-page catalog issued recently by the company. The catalog also describes lift jack systems, wheels and casters.

10-14 Marlate Data

"Facts About duPont Marlate" are outlined in a bulletin issued by the E. I. duPont de Nemours and Co., Inc.,

The booklet suggests the best uses of methoxychlor as an insecticide and is concerned solely with farm crop application of the chemical. To make it easier to file, the bulletin is punched for use in standard three-ring notebooks.

10-15 Payloader Shovels

Bulk material handling applications of Payloader tractor shovels in many different types of plants is described by the Hough Company in a new catalog. Job studies and performance data are included along with 50 on-the-job photos.

10-16 Pesticide Processing

Broad usage of Attaclay in principal pesticides being produced today is discussed in a bulletin put out by Attapulgus Clay Company. It is the first in a series designed to cover the various aspects of the subject of pesticide processing. Physical and chemical properties and formulation characteristics of the carrier and diluent product are discussed.

10-17 Fertilizer Explanation

A simple booklet explaining fertilizers has been prepared by International Minerals and Chemical Corporation. It was printed in response to requests for a basic explanation of plant foods and their uses. Manufacturers and dealers may find the booklet valuable for answering similar requests from their customers. Simplified illustrations are used to explain content and effects of fertilizers. The booklet gives a single brief explanation of the purpose, function and manufacture of fertilizer. Complex fertilizer terms are explained in simple language.

10-18 Sulfur Shortage

There need be no sulfur shortage, according to Langbourne M. Williams Jr., president of Freeport Sulphur Company. But Williams goes on to point out that while the chemical occurs in many forms and is found in abundance throughout the world, economic conditions have caused sulfur stockpiles to drop to a minimum for national security. Williams suggests a realistic approach to the critical problem in a booklet offered by the company.

He recommends that the total amount of sulfur which producers are ordered by the government to ship must be limited to the amount of sulfur being produced. "Otherwise," he states "we shall delude ourselves into thinking we have solved the problem when all we have done is to cut into our essential inventories. We cannot eat this cake and still have it in time of need." Williams says in the booklet that unless something is done now about the shortage, it can have serious and far-reaching consequences on the entire defense program.

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Attention: A. M. Brodine, Managing Editor

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Pasture Laboratory:

DuPont Tests Seed-Coating

ON 72 FARM fields in 19 states, portions of pasture and hay land were turned into practical experimental laboratories this past summer. Data compiled by Du Pont Company plant pathologists as a result of these tests show more livestock feed per acre may be expected when a new farm chemical is applied to grass and legume seed to protect it against seed-borne and soil-borne disease organisms.

Test were arranged with farm owners who were seeding a variety of forage crops as a regular farm management practice. In each case, a portion of the field was planted with seed treated with an organic sulfur compound known as "Arasan" seed disinfectant. Remainder of the field was planted in exactly the same manner with untreated seed from the same source.

While test conditions reflect variations in soil moisture, texture, fertility, and seeding methods on 72 fields in wide-spread sections of the country, averages show a healthy increase in plant stands in favor of treated seed. The chart shows average results with principal forage crops:

CROP	NO. TESTS	INCREASE
Alfalfa	28	33%
Alfalfa-clover mixture	11	44%
Sweet Clover	7	6%
Miscellaneous legumes	9	22%
Sudan grass	7	51%
Miscellaneous grasses	10	36%

In each test, plants were actually counted in measured areas of both treated and untreated seedings. A number of such areas were spotted through each section of the field to avoid selection of locations where fertility or drainage was particularly favorable, or unfavorable. These plant counts from treated and untreated seed were then compared to determine the value of the new treatment.

The "Arasan" coating on the seed actually serves as a chemical "overcoat" to protect the tiny plant embryo from invasion by fungus diseases such as seed rot, seedling blight, and damping-off. The chemical is toxic to these disease organisms, yet harmless to the seed itself.

The importance of seed treatment to control of plant diseases in grain crops has been recognized for many years. Extension of this practice to grass and legume seeds has been made possible through the development of "Arasan" seed disinfectant. This material does not injure these tiny seeds as would some of the mercury compounds used on grain. Advantages of treating these small seeds have been demonstrated in greenhouse flats and small field plots during the past two years. The cooperative demonstrations with farmers this year provide practical large-scale tests under actual farm conditions.

The average increases cited for various crops are believed to reflect results the grower can expect under ordinary conditions. Top results in the 1951 tests include an Illinois field where treated alfalfa seed produced 137 per cent more plants than untreated; a 47 per cent increase in an alsike clover stand in Minnesota; an even 100 per cent more alfalfa from treated seed in Colorado; a 134 per cent increase of treated over untreated alfalfa-clover mixture in Illinois; a 138 per cent increase in Sudan grass in Indiana; another Sudan grass test showing 113 per cent increase, this time in California; a 43 per cent increase in red clover in Indiana; a 78 per cent increase

These 10 Marietta Air-Cell tanks at North Little Rock, Arkansas, were custom built to provide dependable, year 'round safe storage at low handling costs.

Our engineers and erection specialists can design and erect a complete storage system to give you this same kind of permanent storage space, when and where you want it.

Marietta tanks keep your fertilizers moisture-free—BONE DRY—protected from spoilage and the elements. Constructed of Air-Cell lightweight concrete staves, Marietta tanks are built to last—to give you wind and fire proof protection—lower insurance rates and eliminate maintenance problems.

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are the farm families throughout the nation who buy your products. Many of their production needs are closely related to yours.

Their success in meeting this year's greatly increased food and fiber goals depends to a large extent upon your ability to manufacture and distribute essential supplies of fertilizers and pesticides.

Farm organization leaders, along with their experienced Washington staffs, are constantly presenting factual data on farm operations to key Congressional and Government officials.

Mounting defense production problems clearly show the need for close liaison between leaders in both groups.

It is apparent that you will both make a greater contribution toward a stronger America with a full breadbasket by . . . working together as partners.

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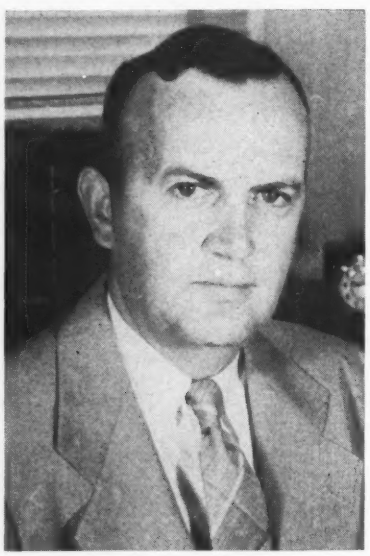
in Dallas grass in Louisiana; a 66 per cent increase in cattail millet in Georgia; and an increase in Virginia of 52 per cent in orchard grass.

Increased stands from treated seed, however, do not tell the full story of advantages from seed treatment. Larger, healthier plants, with more vigorous root systems which enable them to make better re-growth after mowing or grazing, all add up to more production per acre at a cost of only about a cent per pound of seed.

Treated seed is now available through a number of seed companies. The grower can also purchase "Arasan" seed disinfectant and either treat his seed on the farm or have it treated by his local seed cleaning and processing plant.

Oldham Promoted

Dr. W. N. Oldham recently was appointed manager of the Azusa, Calif., plant of American Cyanamid Company. Dr. Oldham joined the company in 1939 and had been



Dr. W. N. Oldham

assistant plant manager for a year.

He was graduated from Kansas State Teachers College with a B.A. degree in chemistry in 1935, and an M.S. degree in 1936. He received a Ph.D. degree from Iowa State College in 1939.

The company also announced the promotion of W. D. Holland to the position of production manager.

10-4 Lightweight Plastic Goggle

A lightweight plastic goggle of one-piece construction is now being offered by General Scientific Equipment Company. Made of moulded

Plastic One-Piece Goggle

rubber, the goggle may be worn with regular glasses.

Available with either clear or green lens, it comes equipped with an elastic band insuring snug fit and a moulded rubber binding that fits natural contours of the face. The goggle provides protection against splashes, dust, and glare.

For additional information fill out a square on the **Reader's Service Card.** Ask for **10-4.**

Plant Food Society Organized in Georgia

Conservation of the agricultural resources of Georgia, improvement of soil fertility, and increased crop production are the goals of the newly organized Georgia Plant Food Educational Society.

The group was organized at a recent meeting in Macon, Ga., and will operate as an agricultural educational service.

Malcolm Rowe, of Athens, was elected president of the organization. Vice presidents are W. D. Barton, M. H. Barnett, W. W. Harley, W. A. Higgenbotham, and Cooper Morcock.

Membership in the organization will be confined to agricultural workers of the various state and federal institutions, fertilizer dealers and fertilizer manufacturers.

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Lion Aqua Ammonia — This product is available to manufacturers for use in the formulation of mixed fertilizers or for sale as direct application material. Normally about 30% ammonia, its content can be controlled by order to suit your needs.

Lion Nitrogen Fertilizer Solutions — Made specifically for the manufacturing of mixed fertilizers, these products supply both ammonia nitrogen and nitrate nitrogen in the ratios desired. They are easily handled and available in three types designed for varying weather conditions, and for formula requirements in the production of fertilizers that cure rapidly, store well and drill evenly.

Lion Ammonium Nitrate Fertilizer — The improved spherical white pellets in this product contain a guaranteed minimum of 33.5% nitrogen. They flow freely, resist caking and store much better. Lion Ammonium Nitrate Fertilizer is shipped in 100-pound, 6-ply bags with two moisture-proof asphalt layers.

Lion Sulphate of Ammonia — This new, superior-type sulphate is guaranteed to contain a minimum of 21% nitrogen. Through special conditioning of the larger crystals, moisture and free acid content is greatly reduced. These factors, together with the special coating applied, make for greater resistance to caking in shipment or in storage. This product flows freely. It is shipped in bulk and in 100-pound, 6-ply bags laminated with asphalt.

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PHILADELPHIA 7, PA.

Ownership Statement

STATEMENT OF THE OWNERSHIP, MANAGEMENT AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, as amended by the acts of March 3, 1933 and July 2, 1946 (Title 39, United States Code, Section 233)

of FARM CHEMICALS, published monthly at Philadelphia, Pa., for October 1, 1951

1. The names and addresses of the publisher, editor, managing editor, and business manager are:

Name of	Post-office Address
Publisher, Sam Lewis Veitch	317 N. Broad St., Phila., Pa.
Editor, A. A. Ware	317 N. Broad St., Phila., Pa.
Managing Editor, A. M. Brodine	317 N. Broad St., Phila., Pa.
Business Manager, A. A. Ware	317 N. Broad St., Phila., Pa.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.

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3. That the known bondholders, mortgagees and other security holders owning or holding one per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above was (This information is required from daily, weekly, semi-weekly, and tri-weekly newspapers only.)

A. A. WARE, Editor.

Sworn to and subscribed before me this 13th day of Sept., 1951

A. F. WALSH
Notary Public

(My commission expires March 5, 1953.)

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MACHINERY—Power Transmission
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MANGANESE SULPHATE
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Armour Fertilizer Works. Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Barrett Div., Allied Chemical & Dye Corp., New York City
International Minerals & Chemicals Corporation, Chicago, Ill.
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NITROGEN SOLUTIONS
Barrett Div., Allied Chemical & Dye Corp., New York City
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NITROGENOUS ORGANIC MATERIAL
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International Minerals & Chemical Corporation, Chicago, Ill.
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POTASH SALTS—Manufacturers
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Potash Co. of America, New York City
International Minerals & Chemical Corporation. Chicago, Ill.
United States Potash Co., New York City

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Spraying Systems Co., Bellwood, Ill.

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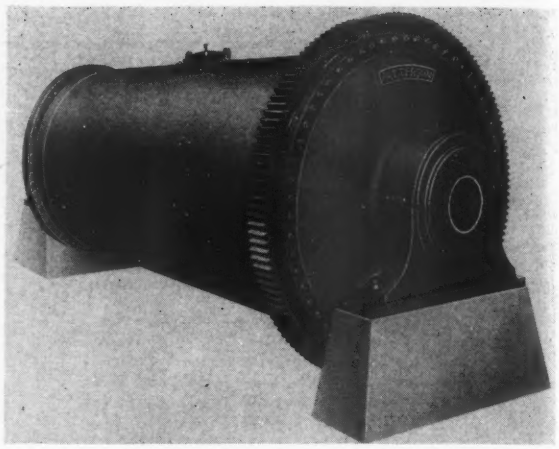


Continuous Ball Mill

ECONOMICAL and reliable continuous grinding operation under the most severe conditions are advantages claimed by the Patterson Foundry and Machine Company for its new heavy duty continuous ball or tube mill.

It is adaptable to all types of grinding, fine or coarse, wet or dry, and open or closed, the company reports.

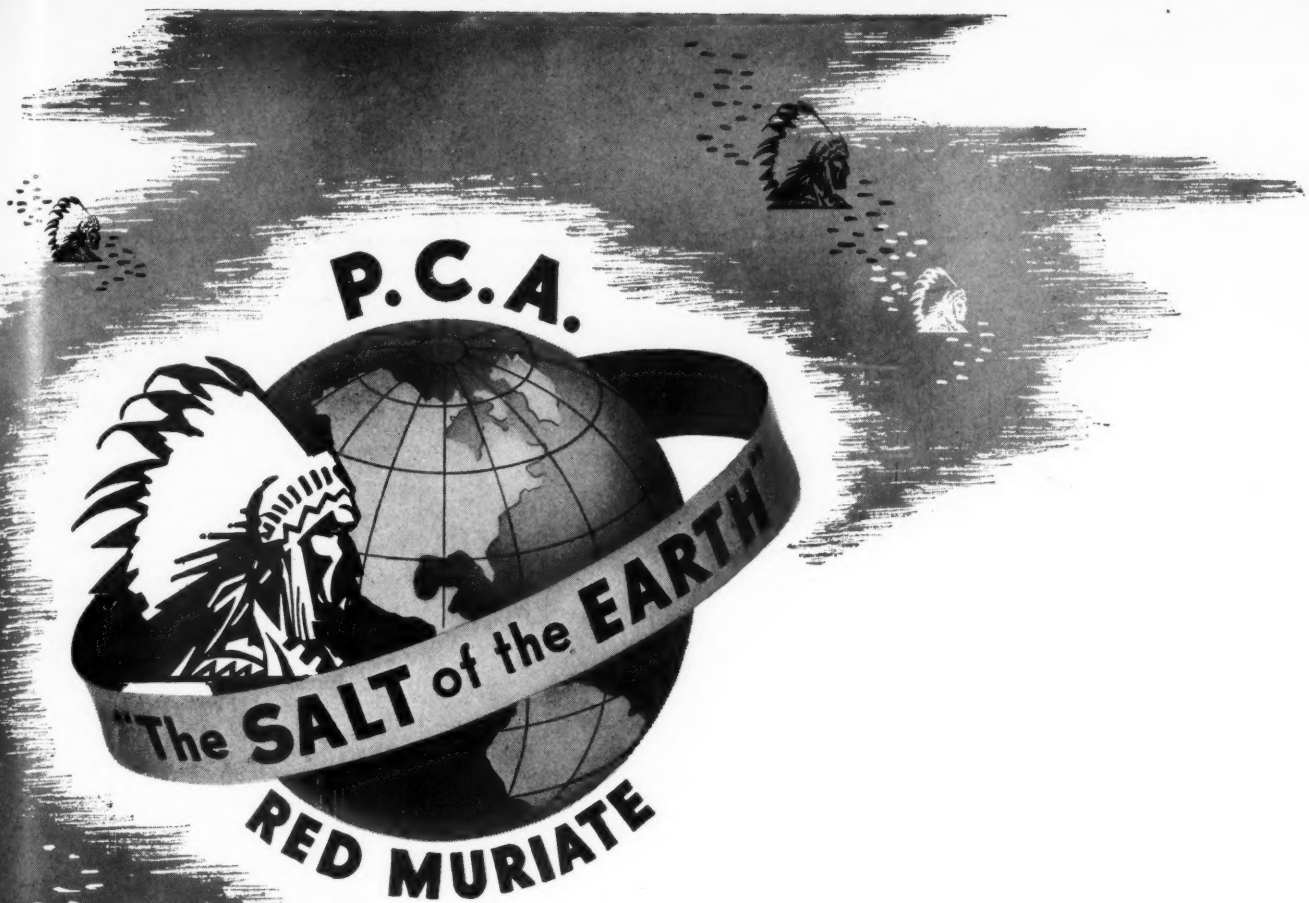
Because of the continuous nature of the instrument, costly shutdowns are entirely eliminated and maintenance expense is reduced to a minimum. The mill may be used to deliver a finished product or it may be operated in conjunction with Patterson classifying equipment of various types. Hollow trunnions are provided for continuous feed and discharge of materials.

Principal design features are mill heads of cast steel construction, slightly conical in shape to provide maximum rigidity and strength with minimum weight. They are easily replaced and have turned and highly polished trunnions. The bands are bolted onto a flange ring on the mill shell, and perfect alignment is assured by a matching recess and shoulder. The shoulder carries the load, it is explained, relieving the bolts of most of the strain.

The mill shell is of welded steel drilled for the installation of the replaceable cast alloy iron or steel lining. Where materials must be ground with a minimum of metallic contamination, the mill may be lined with buhrstone or acid-resistant Porox blocks.

The mill is driven through a heavy "T" section girth, or ring gear, split and reversible to provide maximum gear life. Using a full depth 20° pressure angle involute tooth form, the gear is said to be the most modern design for open gear operation, with a maximum allowance for wear and tooth strength. The main gear meshes with a forged steel cut tooth pinion mounted between heavy duty countershaft bearings.

A descriptive bulletin on the mill may be obtained by filling out a **Reader Service Card**, using number **10-19.**



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MIDWESTERN SALES OFFICE...First National Bank Bldg., Peoria, Ill.
SOUTHERN SALES OFFICE...Candler Building, Atlanta, Ga.

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